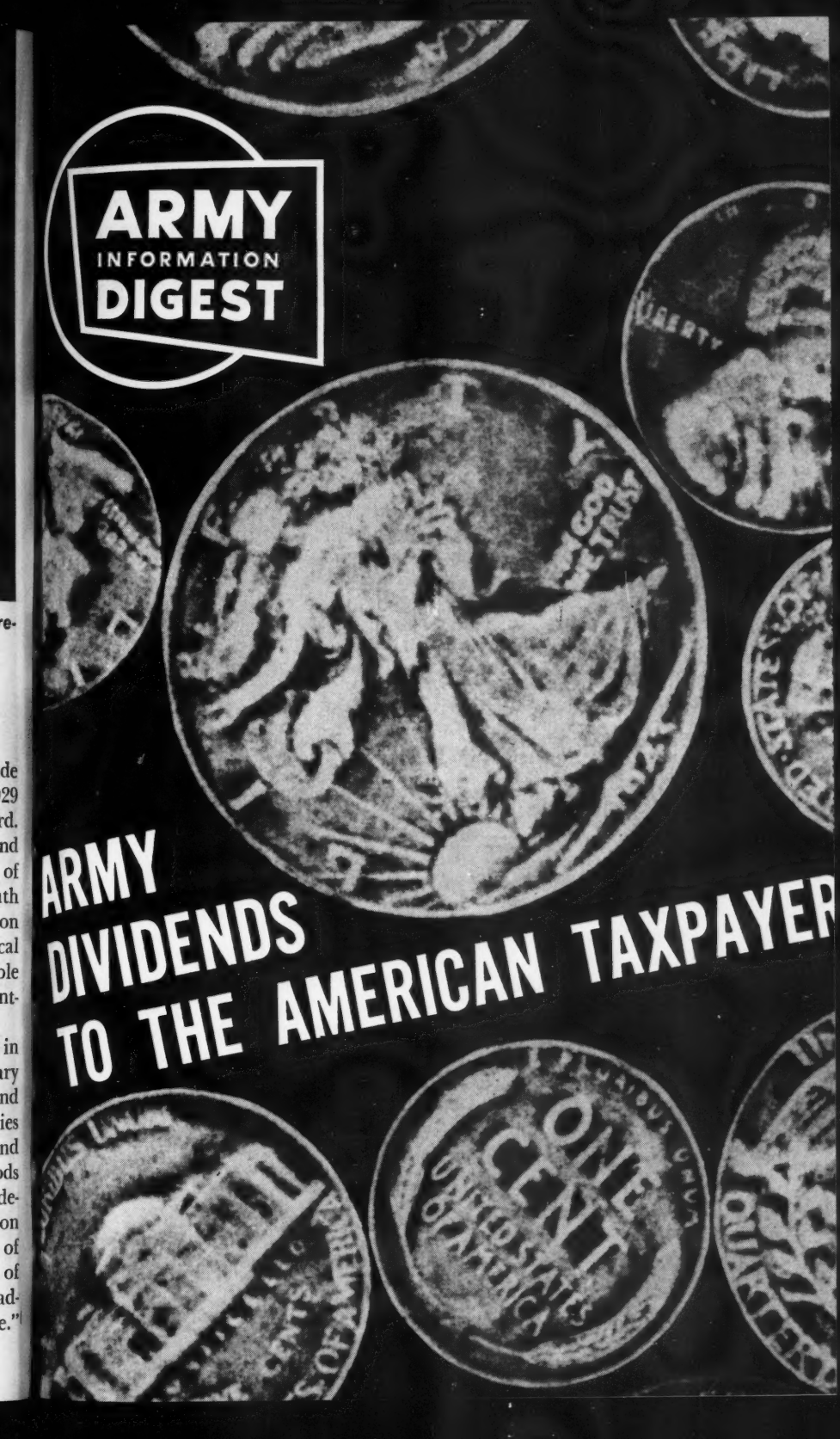

ARMY
INFORMATION
DIGEST
ARMY
DIVIDENDS
TO THE AMERICAN TAXPAYER
LIBERTY
IN GOD WE TRUST
ONE CENT

This is the Army nobody knows. Greate[st] and pioneering achievements through 18[th] of [the]

ARMY DIVIDENDS TH[E]

PRACTICALLY any schoolboy today would associate the name of Eli Whitney with the invention of the cotton gin, and probably could trace some of the economic effects thereof.

But rare would be the schoolboy —or even the advanced student— who would associate Whitney with modern mass production which has meant so much to the productive energy, wealth, and military strength of this Nation. Probably rarer still would be the person who would associate the United States Army with Whitney's contributions to the industrial might of the country.

Yet it was Whitney, spurred by the Army's orders for swift production of arms during a crisis with France in 1800, who dumped 15 sackfuls of hardware before a group of Army officers and from the parts put together ten muskets. Whitney employed subcontractors and assembly line methods to fill his first order and, during the War of 1812, produced some 15,000 muskets by this new method.

The incident is selected because it typifies the manner in which, from earliest times, the United States Army by its sponsorship has contributed to the economic and industrial life of the Nation.

Inevitably, of course, it is true that *somebody* would have thought of the idea of interchangeable parts and of mass methods of production—but it also is true that it was accomplished more quickly with Army inspiration, support and Army funds. The incident typifies how the Army has paid a rich, extra dividend on every dollar provided for the primary purpose of maintaining a security force.

DOZENS, scores, hundreds of other incidents might have done just as well to illustrate the point in dramatic fashion—

- To the average person Lewis and Clark connotes a daring expedition that opened the West to settlement. Few recall that it was an Army mission.
- Millions of persons daily use the Nation's vast network of roads and railroads yet few realize that Army engineers pioneered many of these routes and built the first roads and railroads. Indeed, for many years the U. S. Military Academy was the Nation's only source of engineers.
- The Panama Canal is known as probably the greatest engineering feat of all times. Few remember that President Theodore Roosevelt, after repeated changes of civilian directors, turned the huge construction task over to the Army Corps of Engineers.

he sum of individual exploits, its developmental activities of peace and war have paid immeasurable

S THE AMERICAN TAXPAYER

- Hand in hand with building of the Canal went the conquest of yellow fever, dread scourge of low, hot areas—another Army achievement.
- The Alcan Highway linking our increasingly important strategic northern frontier with the States, was Army-built. Today the Army operates the U. S. Army Alaska Communication System.
- Today thousands of airline passengers fly in safety through fog and murk because of radar—the early theory of which was conceived by an Army Signal officer who today holds the basic patent.
- Only a few months ago thousands of persons were inoculated against the Asian type of influenza. Army medical scientists in the Far East had identified the virus in time for the American drug industry to develop the vaccine which minimized effects of the epidemic.

FROM even this quick listing of a few examples, chosen at random, it is apparent that the United States Army must be considered as an institution that is both an economic and social factor in the life of the Nation. Far from being merely an instrument of national security—useful only when the country is at war—the United States Army is an agency of government which:

1. Performs functions that no other agency is organized and capable of performing. By corollary, some other agency would have to be maintained, or other agencies would have to be expanded, to perform these functions.
2. Acting either by itself or as a catalyst (as in the case of Whitney), develops equipment or processes for purely military purposes that have a variety of civil applications.
3. Working alone or in conjunction with civilian agencies, conducts research and development along many lines.
4. Through all of these and other means, contributes to the life, progress and prosperity of the Nation.

SOME of these contributions are direct, tangible, measurable, although admittedly it would be most difficult to set any hard and fast figures. Others are indirect, intangible, but nevertheless real. Some have been incidental by-products to military developments. Still others have been the results of planned cooperation with commerce and industry.

Probably not since the days of ancient Rome, when her armies built roads and aqueducts, pacified warlike tribes, extended her civilization and maintained the peace of the known world, has an army been such a responsive and responsible agency of government.

The analogy, indeed, is most apt, since both young Rome and the young United States faced much the same problems in westward expansion, and a trained armed force was the logical—indeed the only—organization that could undertake the tasks at hand. Where Rome built walls in northern Britain and established forts and walls along the Germanic and Middle East borders, the American Army today maintains ramparts in Europe and the Far East; administers vast areas; extends assistance to our allies; helps rejuvenate local economies, which in turn helps the American economy by relieving it of the need for direct aid; acts, too, as emissaries of goodwill.

Yet certainly even Caesar, with all his political genius, would be astonished at the difference in policy and outlook in administering once-hostile territory. Where the Roman legions (and most armies through the ages) were concerned largely with conquest and exploitation of defeated peoples, the United States Army during World War II and in Korea was prepared to take over the reconstruction and administration of territory that had been occupied.

The difference in policy and outlook is a direct reflection of the entire philosophy of the American system of government dating from earliest times. It is a reflection of the manner in which the Founding Fathers conceived of an Army, not as an agency standing apart or to be used in machinations of power politics, but as a defense organization responsible to the civil government.

IN THIS role the Army through the years had had three main functions—

- to be trained and ready for war;

Army explorers, engineers, roadbuilders, helped in opening the West to advancing population. Fort Dearborn, as it appeared in 1820, became the city of Chicago.

This scene greeted Army rescuers rushing to aid in Texas City disaster, 1947.

- to operate in certain civil projects fields—such as river and harbor improvements, topographical mapping, large engineering projects; and
- to assist civilian authorities in times of disaster or other emergencies.

It is in the latter two missions that the Army most apparently contributes on a planned basis to the Nation's general well-being.

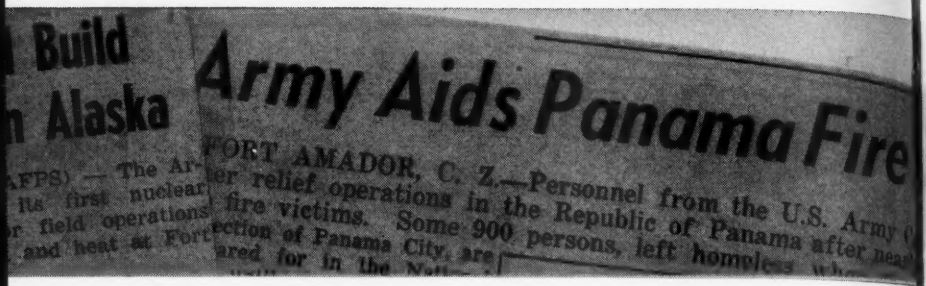
The work of maintaining and running such projects as the Panama Canal or the Alaska Communication System, or of dredging a river mouth, building levees and flood protection systems—all are examples in this area, although too often many individuals do not realize that it is the Army that is actually performing these variegated services.

Emergencies, in which the Army rushes to the scene with men and equipment, are perhaps more dramatically apparent to the public—as in the San Francisco earthquake in 1906, the Texas City explosion in 1947, the recent New England floods.

All of these activities, however, are part of the Army's job. In fact, the work done by the Corps of Engineers in flood control, main-

WHILE the railroads may owe much to Army engineers, few people today realize that an Army engineer contributed greatly to rapid transportation which made possible the growth of American cities. Six years after the Civil War, Major General George S. Greene pioneered design of the municipal elevated railways which for many years dominated the local transit scene.

Other Army engineers who helped build the early railroads included George B. McClellan, chief engineer of the Illinois Central and president of the St. Louis and Cincinnati Railroad; and Braxton Bragg, chief engineer of the Gulf, Colorado and Santa Fe. McClellan (also inventor of the saddle named after him) was a Federal General while Bragg was a Confederate leader in the Civil War. General Ambrose E. Burnside also served in managerial capacity for several western railroads.


Build
Alaska
Army Aids Panama Fire
FORT AMADOR, C. Z.—Personnel from the U.S. Army
relief operations in the Republic of Panama after
fire victims. Some 900 persons, left homeless

tenance of inland waterways, harbor work and similar improvements, is carried out as the Civil Works Program of the Corps. It is apart from the Corps' military missions, and is appropriated and paid for like other governmental programs. As such it can not be considered an extra dividend—but, at the same time, the very existence of an engineering organization that can shift to a wartime footing is a factor of immense military value.

Research in such fields as soils mechanics, beach erosion and hurricanes, new designs in dredges and research into their uses—all these are definitely bonus benefits. Thus even in functional areas where the Army is maintained for the direct assistance and benefit of the general public, it produces by-products of value to the civilian economy.

It is in the area, however, of maintaining a large, complex organization and training it to be ready for the supreme emergency of actual war that the Army really returns tremendous dividends on the taxpayer's original investment in national security. Inventions, processes, improvements and pure research into engineering, trans-

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AN INFESTATION of Mediterranean fruit fly threatens the citrus crop in Florida—

Two aircraft collide over the Grand Canyon, the wreckage falling into well nigh inaccessible spots—

A volcano erupts in Hawaii—

Floods, hurricanes, tidal waves, tornadoes, strike in widely separated places—

In remote Panama, an outbreak of the dread yellow fever occurs—

In all of these instances and many more, the Army has assisted civilian authorities in disaster and emergency relief operations. Hundreds of missions were so small in scope as to attract little recognition; others were dramatic and newsworthy. But in any event all are typical of the way in which the Army fulfills its mission of assisting in emergencies, in response to calls from civilian or military agencies.

AMONG the more unusual of these events in the last several years were—

Support of civil and military agencies during the volcanic eruption on Hawaii in 1955;

Use of Army helicopters to reach the wreckage of the airliners in Grand Canyon in June 1956;

Rapid survey of stricken areas for accurate damage assessment and emergency relief during the tidal wave in Hawaii in 1957;

Support of rescue operations following Hurricane Audrey in Louisiana.

Army helicopters loaned to the Department of Agriculture during the summers of 1956-57 assisted in destroying the Mediterranean fruit fly in Florida.

In addition, emergency relief was provided during more than 15 floods and 45 forest fires. More recently, Army helicopters were used for rescue and relief work during the February 1958 blizzard along the eastern seaboard.

SAILORS on merchant ships, passenger liners and the growing number of pleasure craft today take for granted the system of lighthouses which protects them. The first successful iron skeleton lighthouse was built in 1847 by an Army man, William H. Swift, at Black Rock Harbor, Connecticut. Six years before he met Lee at Gettysburg, Major General George G. Meade had built the Sombrero Key Lighthouse 50 miles east of Key West, Florida. Earlier Meade—who had resigned from the Army shortly after graduating from West Point in 1835—had surveyed the Mississippi delta and assisted in determination of the Texas Boundary. He also served as head of the Northern Lakes Survey from 1857 to 1861.

portation, medicine, food and textile technology, communications, nuclear physics, even in the usually prosaic field of business management—all have salutary repercussions in the civilian economy.

While the primary concern of the Army is that of national defense, the fact remains that the Army as an agency of the Government very frequently produces inventions or processes which are quickly absorbed by private industry—devices which private initiative would not have worked on because of lack of an originally existing commercial demand.

An instance is the previously mentioned utilization of radar in commercial flying. Research and development in this field was begun by the Army and other services as well, several years before World War II, and was spurred to greater perfection by the whiplash of war. Once having been perfected, the commercial uses became apparent—yet had it not been for military necessity it might never have been developed or at best would not have been so quickly perfected.

IN many cases the Army today is underwriting civilian research and development aimed primarily at developing industrial or manufacturing processes which actually will have primary effects on civilian economy before they can be utilized by the military.

Such a case is the development of what amounts to a new industry—the mining and manufacturing of titanium, a "wonder metal" lighter than aluminum, stronger than steel. Long known for its extraordinary qualities, this metal had but few commercial uses prior to 1950. It was extremely difficult to work. The Ordnance Corps instituted research at its own arsenals, through universities, and in conjunction with metallurgical industries and other governmental agencies, to lick the problems.

Through a program of research and financial aid, titanium technology has been sufficiently advanced so that its utilization in large-scale production is in sight. Ultimately household and automotive equipment utilizing titanium will be on the market; aircraft production will benefit, too.

Quite obviously, of course, the principal aim of the Army was to provide for lighter, stronger guns, tanks, automotive equipment and other materiel; but equally obviously the work in titanium would never have moved so swiftly apace toward civilian application had it not been for Army sponsorship.

MEDICAL ADVANCES

PROBABLY no other field of endeavor has produced such direct benefits to the public welfare as has the Army Medical Service during nearly two centuries—benefits affecting the lives of every American (and people of other nations as well), yet benefits that all too often are never associated with the Army.

Frequently wartime necessity may lead the Army to develop or invent something that has widespread civilian impact. Such a war-spurred contribution was the research that led to discovery of an acceptable substitute for quinine.

American troops, faced with the rigors of fighting in steaming jungles during World War II, had to be protected against the ravages of malaria, yet the natural sources of quinine were held by the enemy. Army medical research came up with several substitutes, which finally led to primaquine—a drug which actually cures the disease, rather than merely alleviating its symptoms.

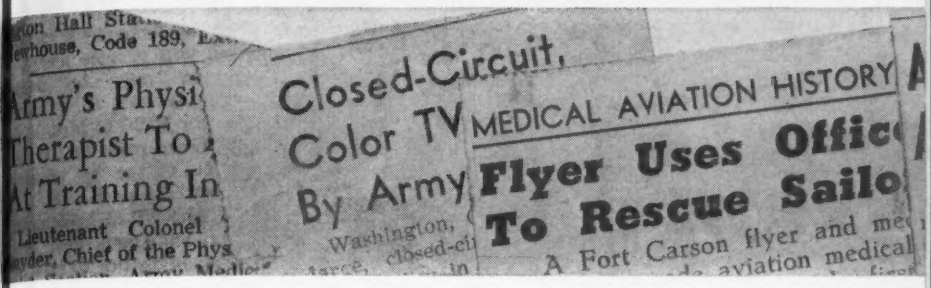
PIONEERING in civilian hospital planning and construction were two Army surgeons—Dr. John Jones, a surgeon with Colonial troops in the French and Indian War and Surgeon's Mate with American troops during the Revolution, and Dr. James Tilton, regimental surgeon and hospital physician in the Continental Army and later Army Surgeon General. Dr. Jones also wrote the first American textbook on surgery, entitled "On the Treatment of Wounds and Fractures." Later Dr. Benjamin Rush, famed physician of Revolutionary times, wrote the first American textbook on psychiatry, advocating humane care and treatment of the mentally disturbed. The first American pharmacopeia, published in 1778, was prepared by William Brown, Physician General of the Middle Department of the Continental Army.

VACCINATION is standard practice today but in 1800 it met considerable opposition. Dr. Benjamin Waterhouse, a surgeon of the Regular Army, introduced smallpox vaccination into this country and earned the title "Jenner of America" as he crusaded for the cause. Even earlier, George Washington had ordered a crude form of smallpox prevention by direct application, arm to arm, among his troops.

The Army's achievement in conquering yellow fever, typhoid, malaria are relatively well known, but few indeed know that their safe drinking water, their children's vaccinations, the safety of the meat products they buy at their neighborhood market, are largely the results of research and experimentation by Army Medical Service officers.

Although the Army Medical Service had its inception on 27 July 1775 when the Continental Congress set up "an Hospital"—meaning a medical department—Army surgeons and physicians had begun their contributions long before, since many of them had served with Colonial or British troops in the wars with France or in Indian campaigns.

From earliest times Army medical men contributed reports on their observations or research to the medical world. An examination of the *Annals of Medical History, Medical Life,* and the *Bul-*



letin of the History of Medicine, at Johns Hopkins University shows that no other group has contributed more writings on the medical history of the country than officers of the Army Medical Service.

Not only in medicine but in many other fields have contributions been made. The Army kept the country's first meteorological records, the job being part of the work of early day Army surgeons. Army medical officers in frontier areas spent much of their off-duty time advancing knowledge of the natural sciences. Contributions were made in anthropology, ethnology, botany, studies of fish and reptiles, and earth formations.

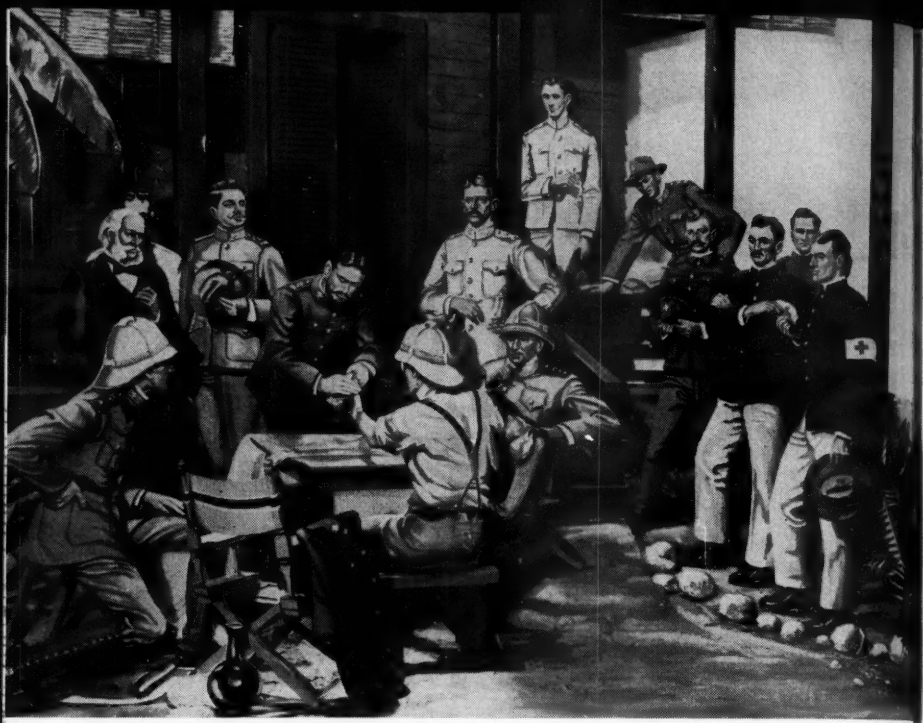
The field of legal medicine owes much to the work of Colonel Calvin H. Goddard who made extensive studies of the identification of projectiles. His work led to a technique that is now used by law enforcement agencies to identify the weapon by which a gunshot victim met death.

A study on digestion made by William Beaumont, an Army surgeon stationed at Fort Mackinac and Fort Crawford, 1825-33, has been regarded as of such importance that it has been said that every person cured of a digestive disorder since his time owes him a debt of gratitude. In 1833, Beaumont published a book "Experiments and Observations on the Gastric Juice and the Physiology of Digestion" which is regarded as a foundation-stone for the modern science of gastroenterology.

CONTRIBUTIONS by Army medicine to the civilian population actually antedate the Revolution. It was in 1765 that Dr. John Morgan, a Philadelphian who had served with the British in the Seven Years' War, helped to found what now is the University of Pennsylvania, America's first medical school. Morgan is usually recognized as the founder "of all medical education in the United States."

TODAY vital statistics are of incalculable value not only in medicine but many other fields. The Army Medical Service kept the first reports upon which vital statistics

IT MAY SEEM a far cry from medicine to modern business methods—but tabulating machines using punched cards owe their start to an Army surgeon. Colonel John Shaw Billings, surgeon and bibliographer, also was a statistician who contributed medical and vital statistical data in connection with the censuses of 1880, 1890, and 1910. In 1880 he suggested that various data "might be recorded on a single card or slip of paper by punching small holes in it, and these cards might then be assorted and counted by mechanical means according to any selected group of these preformations." The Bureau of the Census developed the suggestion and thus was born the first punched card tabulating machine.



A dramatic moment in medical history is put on canvas, showing Dr. James Carroll, first man to contract experimental yellow fever, being inoculated with an infected mosquito by Dr. Jesse W. Lazear who died later of the disease. Looking on (with hand on hip) is Maj. Walter Reed; seated left is Gen. Leonard Wood, then Governor-General of Cuba. The time is shortly after the Spanish-American War.

are calculated. The early annual reports of the Surgeon General of the Army are prized reference works. First important publication on vital statistics was prepared by Assistant Surgeon Samuel Forry, under direction of the Surgeon General Thomas Lawson. Appearing in 1840, it embraced twenty years, from 1819 to 1839.

An important contribution to pathology and medical research was made by Surgeon General William A. Hammond in 1857. During the Civil War he established the Army Medical Museum, from which grew today's Armed Forces Institute of Pathology.

Much has been written about the work of Major Walter Reed, who demonstrated that yellow fever was carried by mosquitoes, and Colonel (later Major General and Surgeon General) William Gorgas who used this knowledge to eradicate the disease during construction

A SEVERE FORM of anemia was once the scourge of large parts of southern United States. Studies by Lieutenant (later Colonel) Bailey Ashford shortly after the Spanish-American War proved that a widely prevalent form of the disease was due to hookworm. His success in treating agricultural workers in Puerto Rico led to extension of treatment to this country through efforts of the Sanitary Commission of the Rockefeller Foundation. Today "hookworm anemia" is no longer an important public health problem in this country.

of the Panama Canal. But it is not so well known that an earlier Surgeon General, George M. Sternberg, had done considerable work on yellow fever, and that he selected Major Reed to head the board set up to study the malady.

General Sternberg also was the author of the first American textbook on bacteriology and was first to photograph the tubercle bacillus. In 1893, he established the Army Medical School, now the Walter Reed Army Institute of Research, called "America's oldest school of preventive medicine."

THE years between the Spanish-American War and World War I saw a vast amount of significant work accomplished in prevention, control and cure of many diseases which plagued mankind in the tropics. Major (later Brigadier General) Jefferson R. Kean first recommended use of the mosquito bar in 1898 as an anti-malarial measure.

Hookworm was established as the cause of a severe form of anemia which had long affected the southern areas of the United States. The mosquito theory of dengue fever transmission was confirmed by Colonel Joseph F. Siler. Emetine was established as a specific for amoebic dysentery. It was established that beriberi was caused by vitamin deficiency stemming from a diet of polished or milled rice—a discovery of profound benefit to large segments of the human race which live chiefly on rice.

LAST YEAR a total of only 50 cases of typhoid fever were reported in this country, despite a low level of vaccination among the civilian population. Credit for this is largely due to chlorination of drinking water sources. It was Major (later Brigadier General) Carl R. Darnall of the Army Medical Service who in 1910 originated the use of liquid chlorine to purify water—a method now largely adopted throughout the world. It has probably saved as many lives as any other medical achievement.

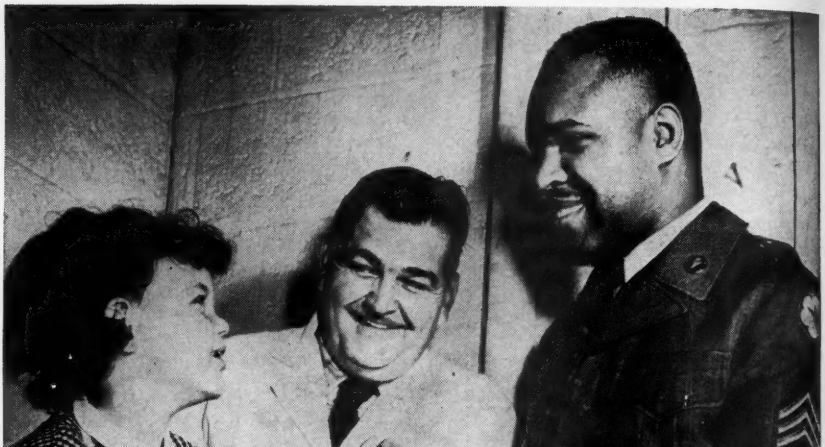
So great were the results of three Tropical Disease Boards established by the Army Medical Service in the Philippine Islands (1900, 1906, and 1922) that the first 20 years of this century have been termed "the golden age of tropical medicine in the United States." Colonel E. B. Vedder was a pioneer in these investigations.

Conquest of typhoid fever by vaccination and sanitary measures was another outstanding contribution. In 1908 Major Frederick Russell made a report on his studies of the epidemiology of typhoid fever which led to adoption of compulsory vaccination in the United States Army—first organization to use typhoid vaccination in the United States on a large scale.

Closely connected with these studies was the origination in 1910 of processes for chlorination of water. Major (later Brigadier General) Carl H. Darnall had worked out the methods.

Mention has been made of the photographing by an Army surgeon

SOME of the first X-rays to be taken in this country were made at the Army Medical Museum in 1896, only six months after Roentgen had made his discovery. Much of this country's pioneer work in this field was done by the Army, especially during the Spanish-American War.



Little Diana Beckett, who lost hand in an accident, learns to use a cosmetic mitten as a patient at Army Prosthetics Research Laboratory.

of the tubercle bacillus. The fight against the "white plague" was continued by the Army. In 1913 Colonel George E. Bushnell established the importance of proper hygiene as a preventive; Major General Charles R. Reynolds, following his retirement as Surgeon General in 1939, pioneered statewide X-ray examinations for detection of tuberculosis.

The Army in cooperation with the Navy and Veterans Administration pioneered in use of streptomycin which was discovered in 1944. Highest proportion of tuberculosis cures in history is being achieved through use of the drug, together with others recently developed.

During World War I troops were plagued with so-called trench fever, a communicable disease something like typhus fever. Col. Richard P. Strong, a former Regular Army officer, directed the committee established by the American Red Cross which found that the disease was louse-borne.

IN THE field of veterinary medicine, the Army Veterinary Corps has contributed greatly to the direct benefit of farmers and cattle growers—and to the general health of the Nation. Included in this field are development of improved vaccine for use against rinderpest, the "cattle plague"; discovery that equine encephalomyelitis (the "Kansas Horse Plague") was transmitted by mosquitoes; proof that a protozoan parasite is a vector of a uniformly fatal horse disease; introduction of a rabies vaccination in which the virus is inactivated by chloroform; establishment that equine ostemalacia is preventable by mineral supplement. Active in these contributions have been Brig. Gen. Raymond A. Kelser and Col. John H. Kinter.

OUTSTANDING contributions have also been made in dentistry. Major Fernando E. Rodriguez of the Army Dental Corps was one of the first to isolate one of the organisms causing tooth decay. Captain John Sayre Marshall performed original work in dental pathology and technic, wrote several textbooks on dentistry and in 1884 organized the Northwestern Dental School.

Extending the use of plastic compounds in making artificial dentures, Captain Stanley F. Erpf, an Army dental surgeon, employed the material for making artificial eyes as early as 1943. Today the artificial types he developed have every resemblance to natural eyes, including movement. They are low in cost and can be made easily compared to the glass type. Dental Corps personnel also pioneered in creating plastic facial features.

Along the same line, the Army Prosthetics Research Laboratory at Walter Reed Army Medical Center has created artificial limbs which are marvels of technical ingenuity, including hands that can do practically everything that human hands can do.

While much of the earlier work

THE idea that Ordnance missile research would benefit sufferers from tuberculosis might at first appear farfetched. Yet when researchers in medical science discovered a few years ago that the "white plague" responded to treatment with the chemical known as hydrazine, it turned out that the chemical was available in large quantities only through Army Ordnance Corps. Hydrazine, in fact, had been developed as a guided missile fuel. Had it not been for military necessity, it might never have been produced. Certainly it would not have been available in quantity at a low cost.

Use of color TV microscope camera at Walter Reed Army Medical Center enables surgeon and pathologist to examine tissue during an operation.

in Army medical fields was carried on by individuals or by specially appointed boards, today it is conducted in a highly organized manner by the Armed Forces Institute of Pathology, and at Walter Reed Army Institute of Research.

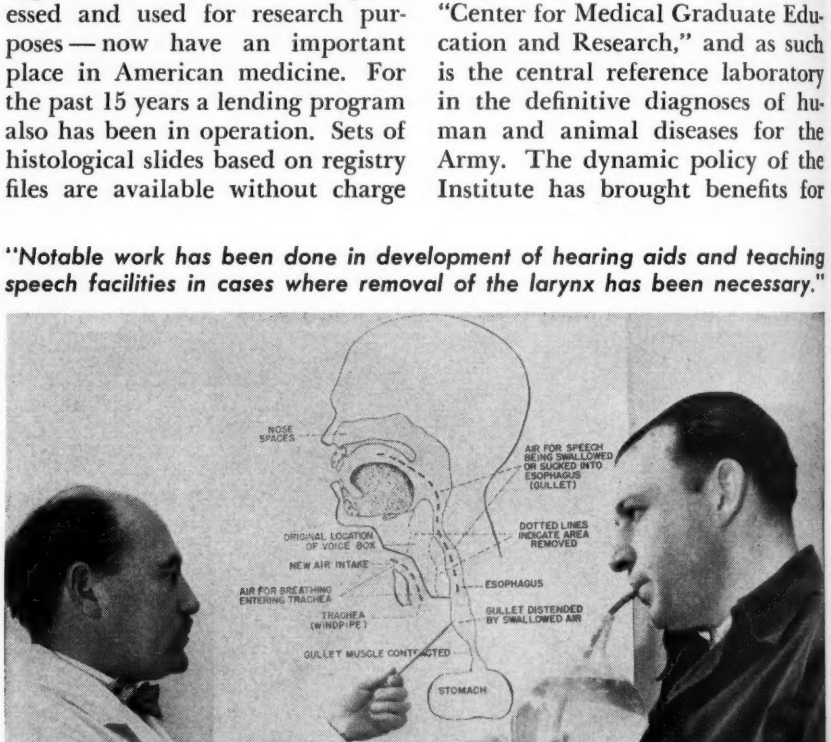
At the Institute, young pathologists of the Army, Navy, Air Force, Veterans Administration and Publice Health Service, as well as from American and foreign civilian hospitals, have been trained.

The Institute's registries of pathology—consisting of material so organized that cases can be processed and used for research purposes — now have an important place in American medicine. For the past 15 years a lending program also has been in operation. Sets of histological slides based on registry files are available without charge to any physician in the United States.

Walter Reed Army Institute of Research, orginally established in 1893 as the Army Medical School, acts in an advisory and consultative capacity for the Office of the Surgeon General, the Army, Navy and Air Force, the World Health Organization of the United Nations, civilian research foundations, numerous Government agencies, as well as scientists representing friendly foreign governments and institutions.

The Institute is described as the "Center for Medical Graduate Education and Research," and as such is the central reference laboratory in the definitive diagnoses of human and animal diseases for the Army. The dynamic policy of the Institute has brought benefits for

"Notable work has been done in development of hearing aids and teaching speech facilities in cases where removal of the larynx has been necessary."



all mankind. Although primarily concerned with military medical problems, the scope of the Institute's interests in world-wide health hazards has resulted in studies in malaria, respiratory diseases, shock, vascular surgery, application of the artificial kidney, use of whole blood and blood derivatives, and many others equally applicable to the civilian. (See "Battlefield Repair of Blood Vessels," March 1957 and "Artificial Kidney," August 1957 DIGEST.)

AS THE field of medicine advances and broadens to meet the complex new problems created by the advancing atomic age, the Army keeps pace, still making contributions in areas that would have amazed such pioneers as Beaumont or even Walter Reed himself.

Scientific research itself was placed on a more scientific, preplanned basis when, during the Korean War, research teams were assigned to the field. As a result, improved vascular surgical methods were introduced; the artificial kidney was used for the first time in treatment of kidney failure occurring in battle casualties; improved methods for treatment of shock were developed; incidence of epidemic hemorrhagic fever was reduced by half and mortality from the disease was cut from 16 to 2 percent.

During the Korean War intensive studies were made in battlefield psychiatry. (See "Army Research Aids Mental Health," January 1957 DIGEST.) And today intensive work is being performed by use of radioactive isotopes. The Army in fact pioneered in this field, establishing the Radioactive Isotope Laboratory in 1950.

In the new field of antibiotics several contributions have been made by the Army Medical Service Graduate School (now known as Walter Reed Army Institute of Research). In February 1949, Dr. Joseph E. Smadel (formerly lieutenant colonel in the U. S. Army Medical Corps) reported on use of chloramphenicol in treating typhus fevers. This drug and other broad-spectrum antibiotics have since been shown to be extremely successful in treating rickettsial diseases. They have now been added to the armamentarium for prevention, control and management of these serious infections. The treatment was field tested in Malaya in 1948. Besides typhus, the treatment may be employed in Rocky Mountain spotted fever and in boutonneuse fever which affects some Mediterranean areas.

Recently the Army Medical Service has made intensive research into treatment of burns, demonstrating the importance of saline solution, plasma and whole blood. In preparation for possible atomic attack, the Army has experimented in the exposure method of treating burns. Results are declared highly satisfactory. (See "Medical Fire Fighters," April 1956 DIGEST.)

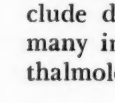
The Audiology and Speech Center at Walter Reed Army Medical Center is engaged in clinical research into methods of preventing hearing loss due to high intensity noises. Notable work has been done in hearing aids and teaching speech facilities in cases where removal of the larynx has been necessary.

At the Ocular Research Unit (also at Walter Reed Army Medi-

cal Center), current projects include development in conjunction with the National Bureau of Standards of a glaucoma detecting instrument; evaluation of a new method of preserving corneas for use in transplantation; use of radioactive isotopes in diagnosis; testing of new therapeutic agents; development of protective goggles and gas mask spectacles; improvement of plastic prosthetic eyes.

Accomplishments of the unit include design and development of many instruments for use by ophthalmologists; study of the electrical activity of the retina by use of an electroretinogram; basic research on a metamagnet for removing nonmagnetic particles from the eye; publication of manuals dealing with operating room techniques, and many others.

Thus in many areas, the Army Medical Service, charged with the primary responsibility of conserving the health and strength of the Army, has made the entire world a healthier place. The contributions of the past 182 years may certainly be expected to continue into the future.



COMMUNICATIONS-ELECTRONICS

IT IS a little known fact that the United States Army founded the Nation's first weather service and operated a nationwide weather reporting system prior to the formation of the U.S. Weather Bureau in 1890. Even today, the Army still contributes to weather forecasting methods and equipment. U.S. Army Signal Corps-developed equipment includes such complicated instruments as a storm detector radar set that can spot storm fronts and precipitation at distances up to 200 miles. Similar sets now are being acquired by the Weather Bureau, the Civil Aeronautics Administration, Navy and Air Force.

Working at numerous laboratories and proving grounds, or in conjunction with civilian industrial firms and educational institutions, the Signal Corps during the 98 years of its existence has had a vast impact on the civilian econ-

IN HOMES all over the country today, better living conditions are being enjoyed because of research and development in electronics undertaken by the U. S. Army Signal Corps.

Father may wear a nearly invisible hearing aid—made possible by transistorization and miniature batteries originally developed for military use.

Mother may cook on an electric range which uses magnetron tubes developed for the Signal Corps. These are now being widely used for high-speed cooking in restaurants also.

Brother and sister probably listen to a miniature radio while the whole family watches a color television set which utilizes synthetic crystals. Successful growth of these crystals by and for the Signal Corps has reduced tenfold the cost of crystals needed for precise control in color television receivers.

The family automobile may well be powered by an engine which uses suppressed spark plugs pioneered by the Signal Corps.

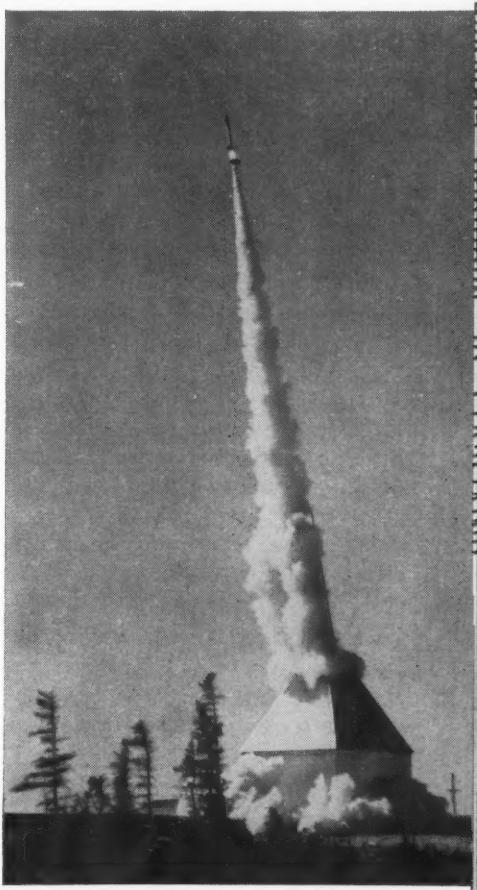
PRODUCTION of weather equipment is not the only contribution the Signal Corps is making toward study of weather. At far off Fort Churchhill, near Hudson's Bay, physicists of the Signal Engineering Laboratories have been firing Aerobee rockets to heights of about 100 miles in connection with studies for the International Geophysical Year. Elapsed time of returning sound makes possible an accurate indication of winds and temperatures. Data obtained from Aerobee firings will be made available to scientists from more than 40 nations who are studying weather and other conditions. The Signal Engineering Laboratories also is conducting similar tests at White Sands, New Mexico, and soon will make soundings from Guam in the West Pacific. (Below, an Aerobee is fired at Fort Churchill.)

omy. In its continued effort to provide the finest and most advanced military electronics and communications equipment and techniques, it has produced benefits to the civilian economy ranging from increased airline safety to tiny hearing aids.

Thousands of American civilians today, for instance, are using tiny radio sets which are cheaper than would have been considered possible only a few years ago. Other thousands are enjoying new vistas of living through use of improved, almost invisible hearing aids.

Militarily inspired demands for miniaturization, more rugged yet lighter and more efficient radio sets, more rapid transmission of typed messages—all have resulted in contributions to commercial communications.

One example was the development of the printed circuit, combined with a development with industry called "auto-sembly" of electronic parts. The printed circuit consists of a plastic board into



AMERICANS today take for granted the weather bulletins they receive through press, radio and television but long before establishment of the Weather Bureau, keeping meteorological records was an extra detail for Army surgeons. James Tilton, Surgeon General from 1813 to 1815, pioneered in the recording of systematic meteorological observations in this country. The work was continued until 1870 when it was taken over by the newly organized Army Signal Corps, which kept up the recordings until 1890 when the U. S. Weather Bureau was established.

which holes are punched to receive tubes while connections or wiring diagrams are etched or printed on the bottom of the board. Molten solder adheres only to the printed or etched portions to form permanent connections. All this eliminates laborious hand wiring.

These printed circuits are used not only in radio and television, but are useful for highly complicated computers, numerous electronic sub-assemblies, hearing aids and other electronic equipment.

Because of the auto-sembly method, annual savings to the Government on defense equipment production alone is conservatively estimated at more than $4 million.

Hand in hand with miniaturization and printed circuitry in radios, televisions, radars, has gone the need for smaller, more efficient batteries. The Signal Corps was largely responsible for design and development of an entire family of extremely small yet highly reliable batteries. These include the mercury, nickel cadmium and zinc-silver-oxide batteries.

At present, nuclear batteries are being developed with an expected life of many years. Research has resulted in prolonging the life of existing types of manganese dioxide dry cells. Experiments have shown that solar cells, which convert light to electricity, can be adapted to power tiny radios.

DEVELOPMENT of patentable ideas by Army personnel also has resulted in considerable benefit to civilian industry. As just one example, two electronic engineers at Fort Monmouth, New Jersey, developed a technique for effectively using printed electronic circuits. Direct result to the Department of the Army — more than $4,000,000 in lower prices for electronic equipment in the first year of operation. In addition, the patent has been made available without charge to American electronic manufacturers.

SOME of the techniques developed to accomplish the wartime mission of psychological warfare are having sweeping impact on peacetime social and economic relationships, not only within the United States but world-wide.

One of these is the development by the Army Quartermaster Corps of a typewriter-like device that can be used to compose a text in more than 50 different languages. This enables people in the most remote areas of the world to receive information quickly, cheaply, and in their own tongue. The machine uses a standard Varityper with changeable type plates. It now is being used by the Navy, Air Force, State Department and Voice of America. Use of the machine permits direct written communication between a business firm in this country with its non-English speaking representatives in foreign countries.

TODAY Signal Corps-developed radar is used by pilots, commercial fishermen, ocean-going ships. The Civil Aeronautics Administration now has embarked on a program to keep all airliners under radar surveillance at all times, using radar equipment derived from sets designed by the U. S. Army Signal Corps for antiaircraft detection. The sets have a range of some 200 miles at altitudes up to 80,000 feet.

Improvements in lightweight military portable electronic equipment—such as the tiny combat receiver-transmitter, for which the best packaging version is being sought for combat use, and the man-pack television system—have resulted in commercial production of comparable sets for industrial and civilian uses. In the area of radio and television, the Signal Corps also has sponsored a process

for aging quartz; this greatly increases the frequency stability of crystals used in commercial communications equipment.

Transmitting printed messages by radioteletypewriter and radiofacsimile has long been used in industry and by news media. Recently the Signal Corps completed design improvements in this field which have already been adopted for commercial communication and news media purposes.

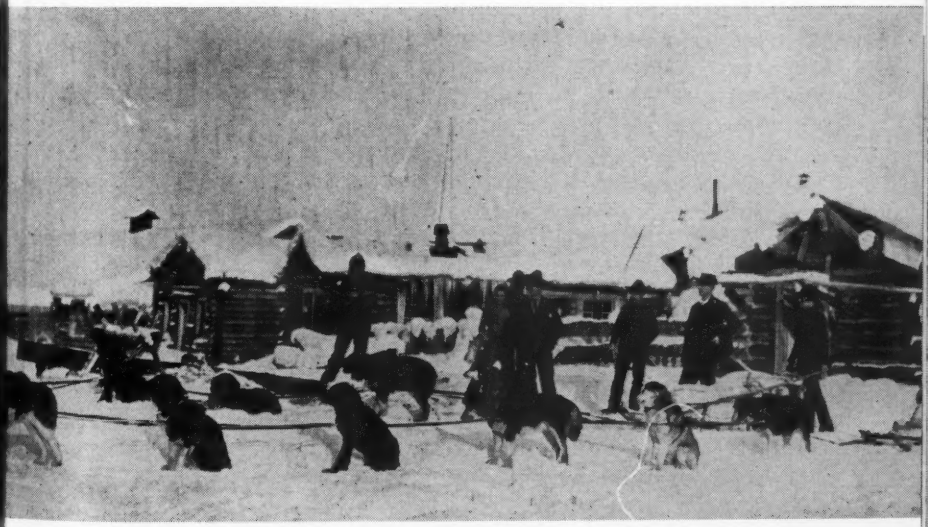
Notable advances, too, have been made in the field of photography, including the design and development under sponsorship of the Signal Corps of plastic paper which eliminates need for a darkroom. It produces photographic prints by application of heat in an oven.

Other research led to development of an optical image evaluation system which allows camera manufacturers to eliminate long trials of lenses. Reduced cost of cameras has resulted. Still other developments include a 16mm movie camera that offers increased quality of sound and pictures, and a 70mm still camera designed for combat use that is expected to have industrial and press applications. Further, ethyl cellulose developed by the Signal Corps now is used for flashlight cases made by four commercial firms.

COMMERCIAL optical items—cameras, fire control equipment, binoculars and so on—today utilize a coating that was developed under Army Ordnance contracts during World War II. Originally the coating, which increases transmission of light, was weak and could be wiped off on contact. Ordnance studies led to development of new coatings tough enough to withstand normal lens-cleaning operations.

In a widely separated field, shock and vibration studies undertaken to devise better packing and shipping methods for delicate equip-

Dog teams supplied winter mobility for Alaska Communication System crew traveling from Circle City to Fairbanks in 1908.



ment have already provided considerable data to transportation media continually seeking to reduce freight damage.

Many other developments—some highly technical—include new and improved methods of microwave radio relay communication; portable TV cameras; mechanical rectifiers for the electrochemical industry; polarized relays for railroads and the shipping industry; internally suppressed spark plugs; miniature thermostats for industrial safety equipment; improved telephone repeaters; superior electronic tubes; and several improved types of wires and insulations.

AS technology and the atomic age advance apace, the Signal Corps, like all other branches of the Army, maintains research and development projects that continue to pay extra dividends on the original investment of providing more efficient communications and electronic equipment for the Army.

In this area is the development of radiation detection equipment designed primarily for battlefield use by troops. At the same time these items—including, for example, detectors which maintain a continuous record of radiation hazards—can easily be adapted by Civil Defense agencies planning defense against nuclear attack.

A most tangible benefit to the entire Nation—both strategically and economically—is the operation of the Alaska Communication System by the Signal Corps. Without it, the present-day development of the huge Territory would have been well nigh impossible.

Discovery of gold in the late 1890's brought stampedes to Alaska, and the Army was called on to maintain law and order. Forts and garrisons were established but they were widely separated and lack of communications made administration difficult. It was not uncommon for a message to require a year to travel from Alaska to the United States and back. In 1900, therefore, Congress authorized the Army to construct military telegraph and cable lines connecting the widely spread garrisons with the Army's headquarters at St. Michael.

Three years later the telegraph and cable system linked all but one post, and connected them through Canadian government lines with Washington. At the same time, linked into this net were the cities of Nome, Rampart, Eagle, Valdez, Skagway, Juneau and others. A year later sea cable facilities had been installed to the United States.

The system's strategic value in World War II was incalculable. After the war, it provided communications during Army construction of the Alcan Highway—a link now being ever more widely used for civilian and military traffic.

Today, by means of land line, submarine cable, high and low frequency radio and very high frequency and microwave radio, the U. S. Army Alaska Communication System offers services over facilities totalling tens of thousands of circuit miles. Thirty-one of its 50 installations are located in the larger population centers, providing telegraph service to other governmental agencies and the general public. At 26 of the 31 public service stations, USARACS provides the public long distance telephone service.

Supplementing the network of stations are more than 300 radiotelephone stations located in remote regions. Many are owned by individual miners, salmon canners, trappers, even a few settlers. Some offer the only means of communication for Eskimo villages in the remote Bering Sea and Arctic Ocean areas. The USARACS also maintains 16 coastal stations along the 23,000 miles of Alaska coastline—a service invaluable to commercial vessels and fishing craft.

ENGINEER CONTRIBUTIONS

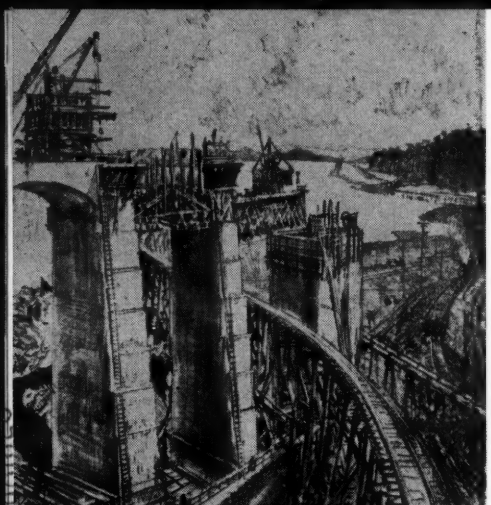
ALONG with the Signal Corps, two other branches of the Army have made immense contributions to develop the potentials of arctic and subarctic regions—the Corps of Engineers and the Transportation Corps.

The Corps of Engineers supervised the building of the famed Alcan Highway. More recently, it supervised construction of the air base at Thule, under conditions that heretofore defied the hardiest and most daring explorers.

Today the Corps of Engineers is carrying on a vast program of research in an effort to learn how to use snow and ice as construction materials for underground dwellings and storage depots, to build roads, large buildings and runways on permafrost, the bottomless frozen muck which covers so much of the north.

This work is being done not only in laboratories but in actual construction in Arctic areas. Already much has been learned—how, for example, to build runways capable of handling the heaviest aircraft, using materials at hand. Methods of putting down

The Corps of Engineers is carrying on a vast program of research in an effort to learn how to use snow and ice as construction materials.



The pulsing drive of Panama Canal construction was cap-

pilings and building bases on frozen ground also have been evolved.

Of tremendous potential for the future of remote areas, contracts have just been let for building the first nuclear power plant in Alaska, to provide both heat and power at Fort Greely. Designed to be air-transportable, the plant is based on the first nuclear power reactor built at Fort Belvoir and now in operation.

An incidental return which promises much for commercial development in the not-too-distant future has been discovery of minerals which await only development of facilities for exploitation. While building air bases and radar warning stations in Labrador and other far northern areas, Army Engineers have turned up deposits of labradorite (a gemstone), at least one deposit of graphite that can be scooped up with the bare hands, quartz, pegmatite and dental spar. Thus vital materials essential in the industrial world may well prove as valuable as the gold which started the initial rush to the Far North.

THE work of the Engineers in the northland is but one contribution to the civilian economy by this branch of the Army. Actually a large part of the work of the Corps consists of its civil works program, carried out apart from its military missions.

This includes such activities as building canals and dams; carrying out the national flood-control program; developing and operating the vast inland waterway system; maintaining and improving all of the coastal and Great Lakes harbors. While this is a primary function of the Corps of Engineers, there is a secondary contribution

THE Panama Canal may be the biggest and most famous but it was far from the first to be constructed by Army Engineers. In 1825 the Erie Canal was begun by the Army. The Chesapeake and Ohio Canal also was built in Maryland—but even then the economy pinch was felt and it never was completed.

Early roads also were Army-built to help open up the country. In fact, military necessity helped open the frontier even before the Revolution. General Braddock had to build roads through the wilderness during the French and Indian wars. Most famous perhaps of early Army-built roads was the Cumberland Pike, first length of which was started in 1806. Eventually, by 1844, it reached from Cumberland, Maryland, to Vandalia, Illinois. On it coaches could make as much as 60 miles a day while cost of hauling freight was reduced to an average of 13 cents a ton-mile—remarkable for the time.

tured in lithographs created by the artist Joseph Pennell.

in the fact that it provides a vast engineering organization which can shift almost instantly from civil works to a trained force for military action—and back again when peace returns.

Historically and traditionally, from the time of the Romans and Alexander the Great, engineers are primarily builders. In the United States the Corps for many years was the only body of engineers; in fact, the Military Academy at West Point was administered by the Army Engineers. The Corps laid the foundation for engineering texts and education throughout the nation.

As early as 1824, it began improving the harbors and waterways. It built lighthouses, and made the Great Lakes navigable, thus bringing together the iron and coal on which the country's industrial strength is based. Engineers explored the West and charted the routes of main highways and rail lines. Army Engineers even built and operated several of the first railroads.

When disaster strikes, the Corps of Engineers is organized to mobilize men and equipment to concentrate on the stricken area. Invaluable relief work was performed during and after the Texas City disaster in 1947, the 1949 blizzard in the west, the New England floods of 1955, to mention only a few of the more dramatic instances.

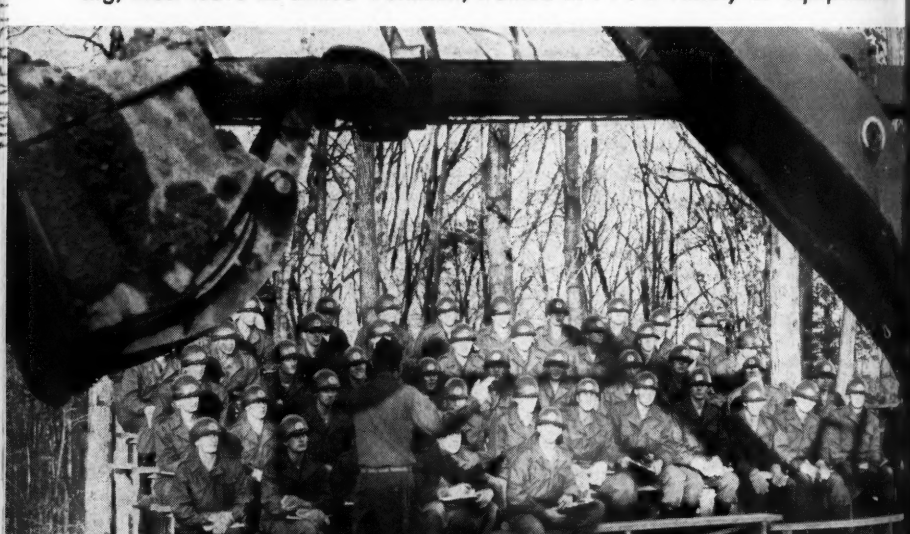
Sometimes the Engineers are called on to perform extraordinary tasks—such as the raising of the battleship Maine from Havana harbor or the removal of mines from our seacoasts after World War II. And it was the Corps of Engineers that carried out the Manhattan District Project that developed the atomic bomb.

Construction of the Panama Canal was a monumental achievement of the Engineers. Today the Corps is serving as the construction agency for the United States share of the great St. Lawrence Seaway, which undoubtedly will have a deep and lasting effect on the Nation's economy.

While all of these projects and others come under the heading of civil works, it may be seen that a good many extra dividends are generated even in this area. This is particularly true of the contributions of the Waterways Experiment Station at Vicksburg, Mississippi. Here the Army Engineers carry out the world's most extensive and elaborate research programs in such fields as soils mechanics and use of models for hydrological

Air-transportable construction items such as this fast, highly productive tractor developed by Engineers will have effect on civilian industry.

"Many of these young men come to the Army with no previous skills or training; most leave as skilled workmen, trained in . . . a variety of equipment."



MANY famous landmarks in the Nation's Capital are monuments to the days when the Army provided the Nation with its only engineers. One who left his mark for succeeding generations was Colonel Montgomery C. Meigs, who after an active career in the Corps of Engineers was called on to serve as Quartermaster General at the start of the Civil War. Col. Meigs built the Cabin John bridge northwest of Washington just a hundred years ago. He also built the old Pension Office Building which established a record at the time with use of 15,000,000 bricks. Col. Meigs also supervised erection of the Senate and the House wings and the dome on the National Capitol. In the shadow of the dome, modern engineers examine the transit he used as a captain.

studies. Both of these activities have innumerable applications in the field of civil engineering.

Through its Beach Erosion Board and its hurricane studies, the Corps of Engineers is accumulating basic data on construction requirements and on protection of all kinds of seaside structures. In connection with its harbor and channel dredging work, great contributions have been made to the art of dredge design.

THE Army Map Service, another Engineer activity, provides essential data for roadbuilding; often, too, its maps are used for exploration for oils and minerals. Engineer topographic surveys form the basis for delineation of boundaries, watershed planning, and so on.

The Army Map Service is in fact the world's foremost mapping institution. It not only produces map sheets, but sends men into the far reaches of the globe, measuring its surface with uprecedented precision and accuracy, bringing back many kinds of intelligence that are coded on maps. It performs intricate calculations required to locate points in the world with respect to one another, and prepares the marvellously precise plates and diagrams on which all this information becomes available to civilian enterprise as well as the military.

The work of the Army Map Service in geodesy (the science of measuring the size and shape of the

Lt. William Clark

earth) involves abstruse mathematics, observation of heavenly bodies, and research into atmospheric, gravitational and other phenomena—all of which are fundamental to advanced work in the satellite field.

One phase of Engineer work involves development of improved equipment. With new concepts of tactics in atomic warfare, and the need for air-lifting of troops and equipment, the Corps is working on air-transportability of existing equipment. Studies are being made in modification of existing equipment to permit quick disassembly for transportation in various types of military aircraft.

Of necessity such equipment must be rugged enough to perform earth-moving, concrete-laying, and the like under wartime conditions. Considerable progress already has been made in production of air-transportable bulldozers, scrapers, rock crushers, graders, air compressors, saws and so on. Obviously all of these new items will have wide application in civilian construction projects generally.

Along the same lines, the Engineers today are conducting studies and experiments in adaptation of tilt-up construction and pre-cast concrete structural forms.

DEVELOPMENT of new military aircraft also is creating some construction problems which—as larger, more powerful jet planes are brought into wider commercial use—may soon have widespread repercussions in airport construction.

LEWIS AND CLARK were not the only Army explorers who contributed to the opening of the West. Another—now but little heard of—was a Major Stephen Harriman Long who after leading exploring expeditions (to the Rockies in 1819 and to the Red River of the North in 1823) spent the rest of his career in railroad pioneering. He was one of the Army Engineers who located the original route of the Baltimore and Ohio railroad. In 1829 he published a "Railroad Manual," the very first book written for railroad engineers. He also perfected several different types of trussed frames for wood railroad bridges. One type named for him was widely used until the beginning of the present century.

Other Army Engineers who surveyed and built the Baltimore and Ohio prior to its opening in 1830 were William McNeil and George Washington Whistler (father of the American painter, George McNeil Whistler.)

The elder Whistler designed and built the first successful American railroad locomotive in 1836. So impressed was the Czar of Russia with his work that he invited Whistler in 1843 to build a railroad from St. Peterburg to Moscow. Whistler died before the project was completed, however.

For example, concrete runways built by the Corps of Engineers to handle supersonic jets now must be level to within an eighth of an inch of deviation in any ten-foot stretch of runway. They also must be much stronger, heavier, and more durable than any civilian pavements now in use. The Corps is experimenting with the use of pre-stressed concrete to reduce pavement thickness requirements. This and similar research may have great significance to future highway-building programs.

Quite obviously such construction standards demand highly trained and skilled manpower. Here again the Army is providing a dividend to the entire Nation, for in filling its own needs the Corps of Engineers alone trains more than 40,000 men annually in skills which have civilian counterparts. Several of these training courses at Fort Belvoir, Virginia, and at Fort Leonard Wood, Missouri, cannot be duplicated—for instance, courses in handling equipment used in making liquid oxygen (LOX) for missiles.

These training programs must be large-scale and continuous. Many of these young men come to the Army with no previous skills or training; most leave as skilled workmen, trained in operating and maintaining a variety of construction and other equipment. As a result, Army-trained men in many other fields as well as engineering, form a great annual increment to the country's pool of skilled labor.

Because it can draw on the "alumni" of the Army's extensive training programs, industry is able to produce goods at lower costs. Indeed, in the search for men qualified to operate heavy construction and other equipment, some firms carry on a continuing employee-recruiting program aimed at men who will be leaving the service.

Capt. Meriwether Lewis

All of this does not mean, of course, that the Army looks on itself as a gigantic vocational school. Nevertheless, since many men are inducted for brief periods, it is absolutely necessary to maintain a continuous program of training for the primary benefit of the Army. The fact that such training also benefits industry may be considered an added dividend. Even further, it should be remembered that Army-trained men who continue in their skills after leaving the service form a valuable reservoir of trained manpower available to the Nation in case of war.

TRANSPORTATION ADVANCES

ALONG with the Signal Corps and Engineers, the Transportation Corps has made significant advances in Arctic regions, notably in developing new types of swift, mobile, off-road transport support. Improved mobility in snow, marsh and desert means much to the development of remote regions.

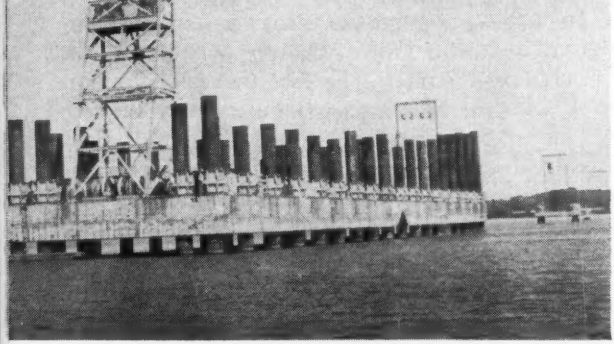
From its very earliest days, the Army built roads, canals, railroads, mapped out and surveyed water and land travel routes. Today this mobility requirement continues to be increasingly important to strategical and tactical concepts of atomic and missile warfare.

Since all fields of transportation are served by highly organized civilian agencies, it is obvious that any development, new technique, or new item of equipment developed for purely military purposes must have an immediate and considerable impact on the entire civilian economy. Since the corollary also is true, the Transportation Corps of necessity works closely with civilian organizations in multi-faceted development effort.

Thus research and development in any area of transportation has, and will continue to have, an effect on manufacturers, distributors and shippers, in fact on every citizen who rides or flies. As a result of purely military research, such developments will include—

- Atomic powered vehicles.
- Better roads.
- Better, more efficient locomotives, utilizing mechanical hydraulic transmission systems.
- Air transportation for areas lacking modern terminal facilities.
- New type ships utilizing the roll-on/roll-off principle to speed freight movements at sea.

DEVELOPMENT of a logistical type cargo-carrier represents a breakthrough into an entirely new field in off-road transportation.



The spud pier has already proved of value to oil companies engaged in deep water drilling, and other operations.

Under this concept proposed vehicles—a prototype has already been developed and tested under arctic conditions—are being designed for ease of maintenance, greater payload to vehicle weight, and use of low ground pressure. They also possess a remarkable degree of buoyancy which facilitates water crossings.

From present trends in this area, Transportation Corps engineers now foresee a dramatic, far-reaching development — propulsion of the logistical cargo carrier by use of nuclear energy.

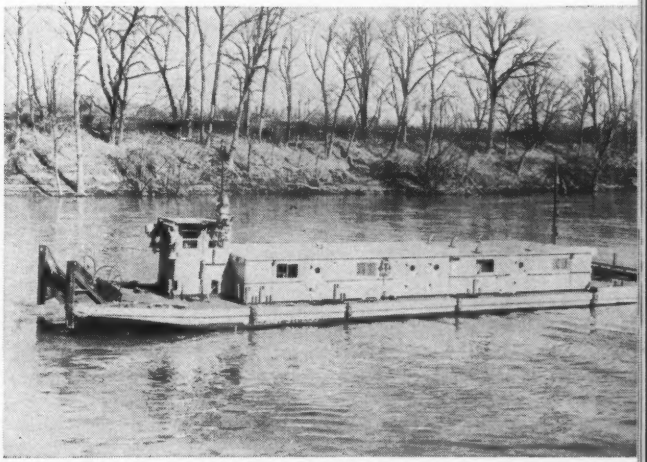
As now envisioned this carrier will be on the order of a freight train of 10 to 12 cars, running on huge low-pressure rubber tired wheels, capable of carrying up to 150 tons of cargo at speeds up to 20 miles an hour over snow or sand. From this it requires very little imagination to forecast that nuclear energy may well be used to propel future American automobiles, trucks and rail locomotives.

Also being pioneered by Transportation Corps engineers is the development of rolling fluid transporters capable of transporting fuel in 500-gallon rubber-tired containers to dispersed areas under all types of terrain and weather conditions.

In addition to off-road mobility problems, the Transportation Corps is making important contributions in aviation; motor transport on roads; rail, marine, terminal operations and equipment; receipt, storage, loading, movement, unloading and delivery of freight.

AT PRESENT the Corps is coordinating Department of Defense participation in a two year long series of road tests sponsored by the American Association of State Highway Officials (AASHO). Transportation Corps personnel will operate AASHO vehicles over a test course for a two-year period. Tests will determine behavior of different types of road pavements under various traffic conditions. Data will help resolve problems related to construction and use of public highways.

Rail transport also is of importance, both to the military and civilian economy. In this field, a current project may have special



More efficient barges and towboats developed through Army research are in use on inland waterways systems.

significance to the civilian economy —namely, the design and development of a diesel-mechanical torque converter locomotive which utilizes a mechanical transmission system. The new locomotive is based on the German Maybach system which the Army has been instrumental in introducing in the United States.

IN THE field of aviation, research and development in the field of vertical take-off landing (VTOL) and short take-off-landing (STOL) hold great promise of major breakthrough in the development of intermediate range transport aircraft capable of very short field performance, yet with wide speed range. This means that many smaller towns and cities which cannot afford expensive runways and airport terminal facilities, will be able to have aerial transport connections nonetheless. Already, in fact, several current Army helicopters can land on buildings with strong flat roofs.

The Army Transportation Corps also is conducting research and development projects in power plants and improved stability, control and performance of aircraft. Gas turbine engines for both fixed wing (turboprop) and helicopters will be lighter than existing conventional engines; aerial trucks will probably soon be in use. Contracts have already been let for studies leading to a "Flying Crane" helicopter capable of carrying loads up to 16 tons.

Besides these specific projects, the Corps is actively engaged in broad research projects in a score of fields aimed at advancing the technology of fixed-wing aircraft and helicopters. Much of this will be reflected in more efficient and economical civil aircraft for private flying and commercial operations.

ON THE sea as well as on land and in the air, the Corps is re-

Bulk containers that can be towed like rollers, and CONEX containers for shipment of miscellaneous cargo, are among Transportation Corps innovations.

sponsible for moving Army personnel and freight. Research and development projects in this area have already led to development of ocean-going ships of the car-ferry types. Several companies have developed this equipment as being commercially sound. Already one prototype of a roll-on/roll-off ship has been launched.

Further studies have produced a towboat using vertical axis propellors which provide thrust that can be applied in any direction for steering. A new Beach Discharge Lighter designed primarily for handling cargo from the roll-on/roll-off vessels, also uses the propulsion system.

In the field of terminal operations, Transportation Corps research programs cover some 50 projects and tasks, all of which imply some degree of benefit to the civilian economy. Briefly, these include such items as mobile cranes, all types of conveyors, aerial tramways, containers, nets and pallets, and quickly erected pre-fabricated barges.

In the general area of atomic and electronics applications, studies having wide potential civilian application are under way. These include transport of atomic weapons, radiological defense measures for rail and port facilities, and application of electronic devices for analysis and solution of logistical movements control problems.

Military needs for developing lighter, more efficient prime movers—trucks, automobiles, amphibious vehicles, and components such as motors, cooling and ignition systems—have had and will have considerable impact in the field of transportation.

ORDNANCE INNOVATIONS

DEVELOPMENT of prime movers and their components is a responsibility of the Ordnance Corps, which is charged with providing both weapons and ordnance supplies—*i.e.*, firepower and mobility—to the rest of the Army. This Corps therefore engages in research and development, both to fulfill its own support mission and to fill requests from other branches such as Transportation, Engineer or Quartermaster Corps.

Already noted have been the benefits resulting from titanium research by Ordnance in its constant quest for lighter, stronger materials for armor and weapons. It is in the field of transportation, however, that probably the most far reaching returns will be made.

The widely used jeep is a case in point. Developed by Army Quartermaster Corps to meet Army needs for a quarter-ton general

THE process for applying a tough, heat-resisting coating on magnesium is known industrially as the HAE process—named for its developer, H. A. Evanglides, a researcher at the Ordnance Corps Frankford Arsenal in Philadelphia. Widely used today by industry, the brown coating is hard as ceramic, resists action of many corrosive chemicals, and is so heat resistant that it will hold together even though applied heat melts the metal that it coats.

NEW vehicle fuels and lubricants with unusual ability to withstand effects of extreme temperature changes were developed under Army Ordnance contracts following World War II. Usually one type of lubricant was used in the tropics, another for cold climates, with the changeover of each vehicle costing around $40.

To test new all-weather lubricants, the Ordnance Corps sent a convoy from Aberdeen Proving Ground, Maryland, to the California deserts where the thermometer often hits 125 degrees Fahrenheit, then to Alaska over the Alcan Highway. The trucks operated there for an entire winter, often in 60 degree below zero weather, then drove back to Aberdeen. Although for military use, the petroleum products which were proof-tested now are in wide commercial use wherever the span between summer and winter temperatures is wide.

purpose vehicle during World War II, the jeep found wide use in civilian fields after the war. Today an Ordnance development that promises to have wide civilian acceptance is the "mechanical mule." Designed under supervision of Army Ordnance engineers at Detroit Arsenal, it was developed for off-road mobility in forward combat areas. Weighing only 900 pounds, it can carry more than its own weight and it also is air-transportable.

That phrase—air-transportability—is the key to much of the work in miniaturization of Engineer, Transportation and Ordnance materiel which is destined to have ever greater impact in civilian fields. Smaller trucks, smaller but just as powerful bulldozers and the like—all these require smaller motors, better components. It is obvious that as these are developed for military purposes, they will find increased civilian use.

One result of research and development in this field has been the completely new family of air-cooled engines for the Army's track-laying combat vehicle fleet. Compact and light, they reduce man hours in upkeep as well as costs of operations. Such motors were not readily available in the civilian market; accordingly, Ordnance Corps developed and proved them, and now civilian manufacturers of automotive equipment will undoubtedly make greater use of them.

ORDNANCE CORPS also is developing a family of trucks designed to meet Army needs from the quarter-ton load to 10 tons. They will utilize the lighter engines. Hand in hand with development of lighter, smaller yet powerful engines goes research into ignition systems, lubrication systems, springs, tires, and other automotive equipment. In all of these areas, Army Ordnance conducts research and development.

WHEN World War II cut off most sources of natural rubber, American ingenuity and inventiveness produced synthetic material which today makes the nation independent of natural rubber imports in an emergency. Beginning early in World War II, the Army Ordnance Corps conducted research far more extensive and conclusive than commercial producers would normally find justifiable. This research is responsible for wide use of synthetics in tires and tubes. In certain respects—toughness, for example—the synthetics are superior to natural rubber.

QUARTERMASTER ACHIEVEMENTS

A PRIMARY utilizer of transportation vehicles is, of course, the Quartermaster Corps which is charged with the responsibility of supplying food, clothing and petroleum to troops in the field. Many advances made by the Transportation Corps have been accomplished directly to fill Quatermaster needs.

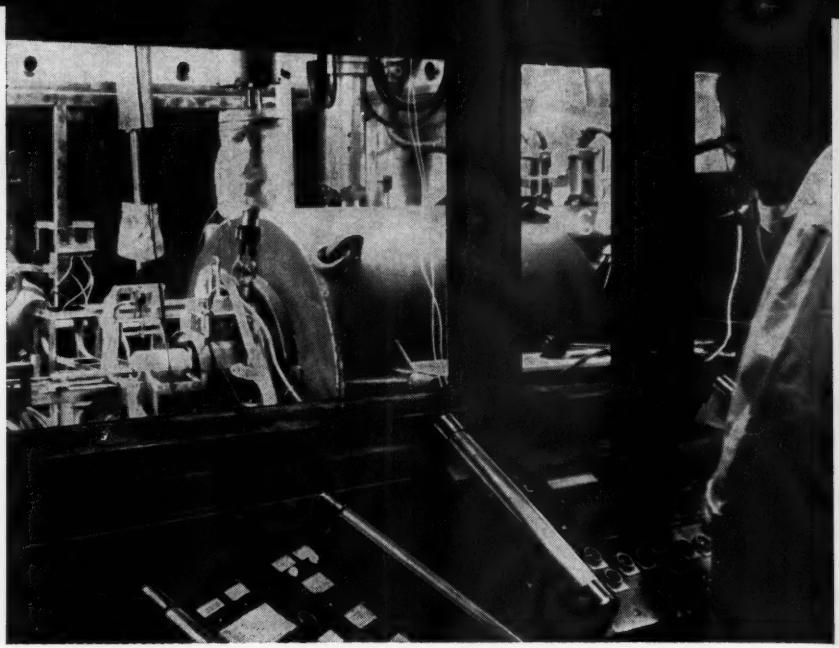
Delivery of goods to troops does not simply entail the purchase of proper quantities at the best prices possible, as was the case in earlier times. Now the Quartemaster Corps is responsible for quality control as well, and here its work has many civilian repercussions.

The Corps cooperates closely with the Medical Department in developing rations, and conducts research into food, clothing, packaging, warehousing—in short, into many of the same problems that affect an average family, only on a vastly larger scale.

Obviously solution on the grand scale to many of these problems can be adapted to the individual home and consumer level to produce dividends in improved foods, better methods of preparation, preservation and packaging, clothing for dress as well as sports, fire and mildew resistant fabrics.

IMPROVEMENTS in food processing and preservation have always been of prime interest to any army, for without adequate sources of human fuel, extensive field operations are quite impossible. Napoleon owed much of his success

A rough-terrain forklift truck, developed for over-the-beach, mud or snow, holds great promise for adaptation to commercial uses.



Canned foods are exposed to intense gamma radiation to determine effectiveness of sterilization methods on long-term food storage.

in extensive campaigns to the fact that under his spur of a prize offer, the canning process had been discovered. The benefits to the housewife everywhere have been apparent ever since.

The United States Army has pushed forward the canning and refrigeration of foods and extended its research into entirely new fields, to include an extensive and accelerated program to evaluate the possibility of employing nuclear radiation in food processing.

Initiated by the Department of Defense in 1953, radiation preservation of foods already has opened vast new horizons to the food industry. The new concept will permit the storage of fresh packaged foods, both with and without refrigeration, for much longer periods than is now possible.

Under Medical Corps supervision, preliminary studies by volunteers consuming a diet consisting entirely of irradiated foods have showed no significant adverse effects. Among food items already successfully processed by irradiation are chicken, some fish, bacon, ham, beef liver, corned beef, codfish cakes, luncheon meats, sweet potatoes, and various fruits and vegetables. Many other food products still require further work, however, to minimize changes in flavor and texture.

Army experiments in dehydrated foods also are having great impact on home preparation of foods. Completely dehydrated, pre-cooked meals packaged in dual-purpose expendable containers (package and preparation kit in one) have already been developed to the prototype stage. This means that after some further studies in storage, such meals will be available for the Army—and very soon thereafter to the housewife.

Work also has progressed in

frozen foods through cooperation with industry. As an example, the Quartermaster Corps has brought to an advanced developmental stage a completely kitchen-ready meat product in the form of six-way frozen boneless beef. The new product simplifies preparation by eliminating requirements for skilled meat cutters in the field.

Not only the food that the family eats but the very clothing that its members wear—especially in the field of sports and camping attire—is being produced either by or for the Quartermaster Corps. Research into cold weather wear is conducted in the Far North while equally important investigation is being carried out on warm and humid climate protective clothing.

Results include development of a combined type of chrome-vegetable tanning agent (already widely adopted by the shoe industry) designed to prolong service life of shoes; a new type heavy shirting fabric containing 15 percent nylon, adaptable for cold-weather work or sportswear; tentage webbing of interest to sportsmen; armored vests using an improved basket-weave armored cloth, adaptable for law-enforcement agencies and even for hunters; various smocks and suits developed for medical and surgical work which are of value to the medical profession; and a protective suit fabricated from flame-resistant fabric, or paper.

In the latter connection, the Quatrermaster Corps has conducted considerable research into flame resistance both of military textiles and of paints. Publications of the Corps are widely used by civilian industrial engineers.

IN performing its mission of supplying food, clothing and other necessities to troops wherever they may be, the Quartermaster Corps has performed extensive research in the field of packaging. Lighter, better packaging of food has resulted, and new methods have been evolved for transporting petroleum and fuel products.

To provide more efficient cargo-handling for over-the-beach, deep sand, snow, ice and mud, the Quartermaster Corps has developed a rough-terrain forklift truck. This replaces a variety of tractors, cranes and sleds previously used for loading and unloading rail flatcars and landing craft, and for handling heavy crates and palletized loads over rough terrain. Its adaptability holds great commercial promise.

One of the Quartermaster-developed items of wide applicability is pneumatic dunnage—*i.e.,* air-inflatable rubber "pillows" used in loaded freight cars to fill empty spaces created by irregularly shaped

MARKING an important advance for the footslogging soldier of the mid-nineteenth century, the Quartermaster Department adopted the first design for shoes that were different for each foot. Prior to the Civil War, rights or lefts in footwear were seldom made—either shoe could be used for either foot. The Army's requirements during the Civil War set a new style not only in military footwear but for all the public. Later, in 1912, Major (later Brigadier General) Edward L. Munson, an Army surgeon serving as president of the Army Shoe Board, devised the Munson last, which was adapted by many shoe manufacturers for civilian use. More recently, the Quartermaster Corps has developed an improved last which, while insuring improved fitting, reduces the number of sizes stocked by one-half.

Arctic explorer Sir Hubert Wilkins (left), a Quartermaster cold weather consultant, participates in clothing research that has had wide civilian application.

or very large containers. It has been estimated that pneumatic dunnage saves 78 percent of labor costs and 46 percent in materials over wood dunnage which is commonly in use. However, the greatest saving will be in reduced damage to cargo.

Along much the same line, the Quartermaster Corps is developing bulk containers for aerial delivery of petroleum supplies and collapsible containers that can be transported in a boxcar, truck or plane or even slung under a helicopter—or if necessary can be towed for short distances like a roller.

A totally different sort of container has more application to the field of every-day living—insulated food containers. The Quartermaster Corps found many containers on the commercial market, but in 1944 developed the first of its kind to incorporate a non-heat-conducting medium between the inner and outer shell so that no part of the metal in either shell comes in contact with the other. The principle now has been adopted in commercial jugs.

An improvement also was effected over old methods of purifying water that might well be carried by campers, hikers or construction crews, in thermal jugs. The new formula, called tetraglycine hydroperiodide, is an improvement over the old halazone tablets which had a chlorine base. The Corps also has developed a formula—trichloromelamine—effective as a sterilizing germicidal rinse where scalding water may be lacking. The solution has value in sterilizing fresh fruits and vegetables.

CHEMICAL CORPS BY-PRODUCTS

CHEMICAL CORPS projects, too, have provided many unexpected returns to agriculture, shipping, health and safety of the general public. In some instances war gases have proved useful in peacetime.

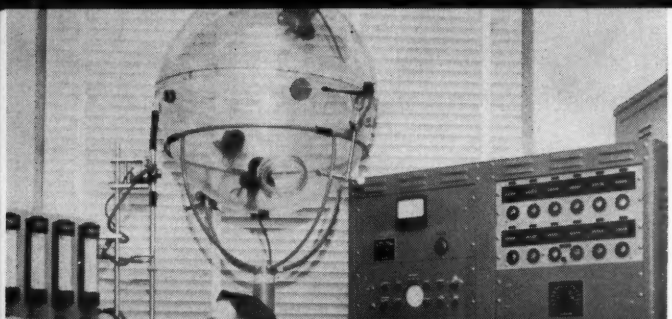
One such case is the use of Lewisite—a vesicant war gas containing arsenic—which was utilized in compounding a derivative that proved to have the highest specific toxicity against marine borers. The Chemical Corps, cooperating with the Quartermaster Corps, Navy and the Department of Commerce, conducted extensive studies at Beaufort, North Carolina, seeking control of these tiny creatures that annually cause millions of dollars of damage to docks and other waterfront structures. As a result, several compounds were evolved that offer excellent control.

The Chemical Corps also was instrumental in developing a poisonous paint now widely used for the exterior of ocean-going vessels to control growth of marine organisms such as barnacles.

In the field of agriculture, the Corps cooperated with other agencies in developing the now widely used DDT and other insecticides. It also has aided in developing rodenticides, and has developed a vaccine against the deadly animal disease, anthrax, which also sometimes attacks humans. Studies also have been made in cooperation with the Department of Agriculture on wheat rust diseases.

The Corps began early studies of reinforced plastics in multiwall sacks, and in overpacks to serve as suitable substitutes for glass car-

Developed for military purposes, a new resuscitation apparatus that revives victims by direct breathing should have wide civilian use.



The aerosoloscope, an electronic device, measures and counts microscopic airborne germs, dust and moisture particles.

boys. As a result, the chemical industry has had available better materials and techniques for shipping dangerous chemical materials.

AS WITH the other Army technical services, the Chemical Corps cannot and does not work in a vacuum. It maintains close relationships with manufacturers and users of chemical products, and new developments by one quickly affect the other. Very frequently the Chemical Corps is able to carry on research and experimentation that no single commercial firm could do, with results of benefit to the entire industry. Development of insect repellents, for example, is one area that has had wide civilian application. At present, the Chemical Corps is engaged in research into insect responses to certain odors. This has already provided a basis for knowledge of factors affecting repellency (and attractions as well) so that insect poisons can be made more effective. The result should be structurally designed repellents that will offer much greater protection for humans and animals.

Commercial flame throwers now in use in agriculture are a direct outgrowth of items developed by the Chemical Corps. These include small knapsack types and tractor-drawn flame throwers that are mounted on cultivators. These are widely used for burning thorns on cactus to render the plant fit for animal consumption, and for controlling field and aquatic weeds.

Important contributions—many highly technical — to industrial manufacturing have been made by Chemical Corps. These include design of remote control handling equipment, devices for detecting minute amounts of contaminants in the air; methods of decontaminating exhausts; salvaging, removing or disposing of toxic wastes; design and operation of standard equipment; modification of existing standard equipment and instrumentation to make it acceptable in toxic areas.

In the field of industrial health and safety, the Army Chemical Corps has developed a fiber diffusion board that provides protection from all known chemical and biological warfare agents. Resembling ordinary fiber board, it contains charcoal and other components, and is so fabricated that air diffuses

through it to provide a filtering action. Capable of being manufactured commercially in large quantities and costing only slightly more than fiberboard, it could be used for construction of small shelters, or as lining for existing structures.

Still another noteworthy contribution are various masks for protection against deadly gases that are the by-product of many industries. These include carbon monoxide masks (developed originally on request of the Navy for protection in submarines), ammonia canister masks, and a Public Health Service mask used widely in fumigation work, where hydrocyanic acid and tear gas are the two agents used.

Development of protective masks is just one contribution of the Chemical Corps to public safety. Much of its research and development is concerned with national safety in case of a war which might conceivably see atomic, biological or chemical attacks launched against the country. Some of the items under development or actually in production for military use—and also quickly adaptable for wide public use—include radiological and chemical warning systems and dosimeters to measure amounts of radiation to which an individual may have been exposed.

One device that has a wide application industrially is an alarm sensitive only to halogens—that is, to warn of chlorine in the atmosphere. The alarm is a simple device capable of detecting a fraction of a part per million of chlorine. Research now is underway to adapt it for use on moving vehicles.

Treatment against fumigants such as hydrocyanic acid also is an object of Chemical Corps effort. Standard treatment has long consisted of sodium nitrite followed by a dose of sodium thiosulfate. Chemical Corps research has now developed an agent (para-amino propiophenone) that has proved efficient as a prophylaxis—that is, administered in advance of exposure—as well as a treatment agent.

Further studies now are being made and if experimental results are confirmed, a single treatment drug can replace the present more cumbersome treatment requiring two different drugs. Indications are that these studies will mark a distinct advance in both military and civilian medicine.

EARLY in World War II, intensive investigations were undertaken both in the United States

Remote handling equipment developed for laboratory use by Army Chemical Corps has had wide civilian application.

and in Great Britain to find antidotes to the toxic action of Lewisite gas. In Britain investigators evolved a chemical called BAL (2,3 dimercaptropropanol) which led to U. S. Army Chemical Corps investigations in this field.

From that work came some remarkable discoveries in use of BAL for treatment of human poisonings by antimony, arsenic, bismuth, cadmium, chromium, cobalt, gold, mercury and nickel—elements used in various manufacturing processes. These are generally lumped together under the designation of heavy metal poisoning. BAL also has been established now as a prophylactic in poisonings by these metals, except cadmium. It is, however, of no use in certain other heavy metal poisonings such as lead.

The end result is that research started in connection with Chemical Corps problems has supplied a treatment of great life-saving value in industry.

OVERSEAS ASSISTANCE

TWO once devastated areas in the Far East—the Ryukyu Islands and Korea—today are vivid examples of how the Army, as an agency of the United States Government, has functioned to restore a shattered economy, give new hope to millions in war-torn countries, and act as emissary of the American way of life in the Cold War.

In the Ryukyus the United States found itself guardian of a virtually completely devastated and disorganized economy. The war had destroyed practically all physical structures and the continuity of economic life, which had never been self-sufficient at best. United States Army administered rehabilitation programs have been conducted to make the Islands progressively more self-supporting. Every feasible developmental project, from power plants to pearl culture, capable of yielding an economic return, has been energetically examined and supported within financial resources during the past 15 years.

To date, the Army can look on a truly impressive list of accomplishments. Unprecedented rates of progress have been registered in improving the health and economic well-being of the Islands. Far reaching economic progress has been made. The per capita income has risen about 25 percent despite a population rise of about a third. The mortality rate has declined considerably from that prevailing under Japanese rule.

In Korea, the Commanding General Eighth Army was made responsible for the Armed Forces Assistance to Korea (AFAK) Program. By the end of 1957, more than 3,400 projects had been completed and more than 150 are under way today. Projects include building of schools, churches, hospitals, dispensaries, libraries, sanitary facilities and streets. Troop units have been authorized to assist to the extent possible without interfering with their military mission. The impact on the Korean economy has been far reaching.

MANAGEMENT IMPROVEMENTS

MOST of the contributions to civilian economy or the public health and welfare considered thus far have resulted from the Army's needs for producing materiel of war, the means of moving and utilizing it, and supplying and maintaining the troops who use it.

In the field of management improvement, too, the Army is continually returning dividends.

Recognizing the principle that where management is deficient, production can scarcely be efficient, the Department of the Army conducts a continual survey of the entire organization of the Army at Department and top staff levels. A multi-faceted Management Improvement Program is conducted, stressing the need for performing tasks better and at less cost.

The Program has produced literally thousands of operational improvements. The resulting savings and benefits have been of major assistance in permitting the Army to carry out its assigned missions in recent years despite mounting costs.

Various management tools are used in the Army's continual campaign to gain more efficiency and economy—work simplification, performance analysis, quality control, manpower utilization surveys, production control, procedure analysis, forms and reports control, to name a few.

Such a planned approach eliminates chance or guess work in establishing better, cheaper and faster ways of performing the Army's day-to-day tasks. It includes a continuous "plow back" of ideas and innovations by command letter, special publications, and directives. All echelons of command are kept informed of activities everywhere in the Army, and commanders make free use of developments that some other installation has accomplished. Thus the chain reaction of ideas and savings extends throughout the entire Army.

IF MORE efficient management and direction of the physical plant is of constant concern to the Army, no less is human management. Here too, the U. S. Army, as probably no other army in history, is concerned with improving the education and moral standards of the young men it receives for training. All this results in a long-range dividend that affects thousands of families throughout the Nation.

The Army views with great seriousness its obligation toward the soldiers. Recognizing that man remains the essential, the one truly imperishable element, in our Nation's security and progress, the Army devotes activities solely to the physical, mental, and moral improvement of its personnel. Information plays a vital part in these activities.

An important task of leadership is to develop the habit of serious thought on the part of Army members. Through information activities, commanders enhance the effectiveness of the Army by providing information to increase understanding. At the same time, the Army recognizes many young soldiers will return to civil life after

AN accident prevention program has been actively carried on for many years by the Army—first to reduce the suffering and tragedy of accidents, and second to increase the efficient utilization of manpower, equipment and money allocated to carry out the Army's mission. Typical of the savings generated by the safety program was the reduction in costs to the Government in accident injuries and deaths by $12,000,000 during Fiscal Year 1957. Savings in equipment and material cannot be estimated but obviously were enormous.

a short period in the service and that they, as well as soldiers on active duty, need to understand America's place in modern history, and their responsibilities as citizens. Through Troop Information, concerted effort is made to explain the "why" of things.

Troop Information thus plays an essential role in increasing the effectiveness of the Army. At the same time, it contributes greatly in developing the Nation's future strength by helping to interest soldiers and former soldiers in all the issues and problems which confront the Nation.

THE Army does not consider that peacetime military service is a dislocation or a period of "lost time" insofar as educational opportunity is concerned. Facilities, incentives and guidance are provided for young Americans to continue their schooling, even to the highest levels. Many who had ceased their formal education long before induction have been prompted to fulfill their potentials through in-service general education and technical training.

The Army's education system comprises on-the-job training; attendance at Army service schools and also at civilian institutions to meet specific requirements; and General Educational Development after normal duty hours.

The General Educational Development Program is conducted in and through installation Army Education Centers and adjacent civilian high schools and colleges. In addition, the United States Armed Forces Institute (USAFI) provides more than 200 correspondence or self-teaching courses, ranging from elementary to college level. Installations with a troop strength of at least 750 are required to maintain at least one Army Education Center with personnel, materials and facilities for advisement, registration, testing, instruction and study.

Outside the Army there are at all times more than 10,000 officers and enlisted men enrolled in civilian school and college classes after normal duty hours. The Army pays a substantial part of their tuition. In continental United States, more than 100 colleges and universities are involved. An accredited United States university, with full logistical support of the Army, operates a program

in each major oversea area.

Classes leading to resident college credit are offered in most education centers. During the past year, Army personnel completed 154,231 courses, more than 32,000 of which were in evening classes of civilian colleges and universities. In addition, and perhaps even more significant from the standpoint of the Army's contribution to the Nation's economy and potential, over 40,000 individuals achieved through GED tests the equivalent of high school education completion.

A program of civilian training also pays dividends to the general economy. Over the past several years the Army has developed a complete series of documents and outlines for training its civilians in sound supervisory practices. Private industry and business utilize these pamphlets at a nominal cost. Frequently representatives of industry attend courses in Personnel Management for Executives, which are presented at The Army Civilian Training Center in the Pentagon.

In addition, more than 700 students at 59 colleges and universities are alternating academic studies with work experience at 30 military installations nationwide under the Army's Cooperative Education Program.

INSTALLATION of an incentive awards system at every level of the Army world-wide has made it possible for Army managers to save the American taxpayer more than $17,000,000 during Fiscal Year 1957. Many of these savings will recur on a continuing basis over the years ahead. New ideas in the fields of electronics, flood control, river improvements, food and clothing and medical care have been directly responsive to this system for utilizing and rewarding employee suggestions. The net result has been a substantial contribution to economical Army operation.

AS THE United States becomes increasingly aware of its role as a power in world affairs, there is a growing interest of the public in military affairs and the military experience of the Nation.

Helping to fulfill this interest, the Army has employed trained historians, given them access to all sources of information, and guaranteed them independence of judgment to prepare an "organized memory of experience" of World War II and Korea. In this the Army recognized two purposes that its history could and must serve—the education of its own personnel, and a record for the benefit and enlightenment of millions who served during the war.

The result — thirty-eight volumes already published on the "U. S. Army in World War II," and fourteen booklets in the series, "Armed Forces In Action." As a dividend to the country, the Army is able to improve its information services, adding range, accuracy and depth to the answers it must give to questions that come from school children, librarians, teachers, students in colleges and universities, as well as veterans and present military personnel.

THE provision of religious services, religious ministrations, religious education, pastoral care and counseling has been a function of Army Chaplains and has characterized their efforts throughout our military history. Today the Army maintains 398 chapels in the United States and more than 400 overseas ministering to the needs of more than a million persons each month.

Reflecting intense interest in the moral and spiritual well being of the individual, the Army in 1947 instituted a Character Guidance

Program as a combined staff approach designed to educate men to assume personal and moral responsibility for their actions toward self, their fellow soldiers, their country and their God.

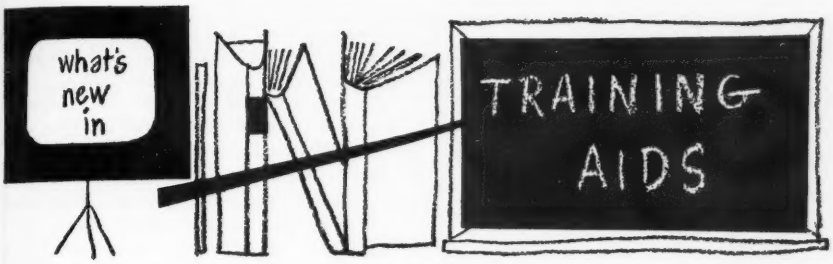
The Army commander and his entire staff is responsible for implementing this program in each unit and installation. Each month the chaplain provides for all troops one hour of education in basic ethical and moral concepts. Basic trainees receive four hours of this type of instruction during their basic training cycle. Other staff officers make contributions in such areas as education, recreation, law enforcement, health, and civilian relationships.

The Army is acutely aware of the part religion and spiritual stamina have paid in maintaining loyalty to duty, to honor, to country and to God. To an important segment of this Nation's population, the Army's religious and Character Guidance Program points the way to the development and protection of an inner strength on which the welfare of the Nation depends.

THUS the Army pays a cumulative dividend to the Nation not only in things material—in contributions to better ways of living and making a living, in greater industrial power—but also in the most essential ingredient of the life of an Nation—better men and women.

RECENT SPECIAL ISSUES of Army Information Digest have been devoted to "The Chief of Staff Reports" (September 1957), "The Army in 1962" (January-February 1958) and "Peace or Piecemeal?" (June 1958). Individuals or organizations requiring any of these special issues for reference may obtain copies as long as limited supplies are available. Requests, indicating issues and number of copies desired, should be addressed to The Editor, Army Information Digest, Cameron Station, Alexandria, Virginia.

SEPTEMBER 1957 **JANUARY 1958** **FEBRUARY 1958** **JUNE 1958**



Keep your organization current with the latest training methods by referring to this section in each issue.

TRAINING LITERATURE

While the following new literature will be published shortly, units are cautioned *NOT* to requisition copies until receipt of automatic initial distribution or the items are listed in DA Pamphlets 310-3 or 310-4.

The Infantry Division. FM 7-100 covers organization of infantry division; tactical and administrative doctrine for employment of the division in offense, defense, retrograde, and in situations short of war, as an independent force or as part of a larger force.

The Signal Battalion, Armored Division. FM 11-11 covers organization, administration, and tactical employment of a signal battalion as organized and equipped under TOE 11-55. Chapter 2 is the principal reference source on the division-level communication system and support provided to division elements.

Carbine Marksmanship Courses, Trainfire I. FM 23- ( ) is designed as a guide for instructors in Carbine Marksmanship Trainfire I training. It includes a description of courses, training aids, targets, and ranges, as well as subject schedules and detailed lesson plans.

Army Transport Aviation—Combat Operations. FM 57-35 provides guidance in planning and executing tactical operations supported by Army transport aircraft (fixed and rotary wing).

Ordnance Class V Support System. TC 9-( ) provides guidance in Class V support service for the Army in the field, pending the revision of FM 9-6.

Revisions. The following revisions will be published:

FM 11-16 "Signal Orders, Records, and Reports" (24-16 renumbered)—revision of 1950 edition.

FM 24-18 "Field Radio Techniques"—revision of 1949 edition.

FM 21-18 "Foot Marches"—revision of 1950 edition.

FM 23-32 "3.5-inch Rocket Launcher"—revision of 1955 edition.

ROTCM 145-41 "Crew-Served Weapons and Gunnery I"—revision of 1954 edition. *Note:* ROTCM 145-42, dated June 1954, will be superseded by this revision.

ROTCM 145-60 "Small Unit Tactics Including Communications"—revision of 1954 edition.

ROTCM 145-80 "Logistics"—revision of 1954 edition.

ROTCM 145-90 "Operations"—revision of 1954 edition.

TRAINING AIDS

Training Films recently released include:

TF 5-2371 "Field Engineering in the Subarctic—Part I—Winter Roads"

TF 5-2450 "Demolitions—Electric Priming"

TF 8-2524 "Prevention of Cold Injuries"

TF 9-2534 "Fuel Pump, Carter Electric, Characteristics and Checks, GMC M135 Truck"

TF 9-2543 "Field Artillery Recoil Mechanisms—Part I—Indirect Method of Checking Nitrogen Pressure"

TF 11-2490 "Radio Set AN/GRC 26 ( )—Part II—Shutdown Check"

TF 17-2504 "Armor Combat Power"

TF 20-2531 "Individual Protection Against Atomic Attack"

TF 20-2561 "The Pentomic Army"

TF 55-2311 "Helicopter Maintenance—Part IV—Supercharged Induction System"

SFS 5-119 "U. S. Heavy Antitank Mine M15"

TF 16-2517 "Opportunity."
TF 44-2544 "The Effects of Electronic Countermeasures on Air Defense Radars"
TF 44-2548 "Surveillance Radar System AN/TPS-ID—Defense Against Electronic Countermeasures."
TF 55-2316 "Helicopter Maintenance—Part IX—Generator Systems Trouble Shooting."
TF 55-2556 "Cleaning and Testing the K Brake (Railway)."
SFS 5-116 "Loading Heavy Equipment in Aircraft."
AFIF 223 "I&E Sportsreel."

ARMY EXTENSION COURSES

New Subcourses

Introduction to Statistics, FIN Subcourse 90, Finance School U. S. Army. Definition, meaning, nature, and limitations of statistics; techniques of tabular presentation; relative advantages and limitations of charts vs tables; charting techniques; construction, graphic portrayal, and interpretation of frequency distribution.

United States Policies Concerning Civil Affairs and Military Government (CAMG). CAMG Subcourse 27, Civil Affairs and Military Government School. United States policies on treatment of populations of liberated and occupied territories.

Atomic Weapons, INF Subcourse 75, US Army Infantry School. Characteristics and effects of atomic explosions; unclassified target analysis; staff planning and functioning in atomic warfare.

Civil Affairs XV (International Law, Conflicts), TJAG Subcourse 72, The Judge Advocate General School. Legal effects of the commencement of hostilities; laws and customs of war.

Civil Affairs XVII (Lands), TJAG Subcourse 82. The Judge Advocate General School. Procedures involved in acquisition of land by the United States.

Administration of Military Justice I (TJAG), Common Subcourse 60. The Judge Advocate General School. Responsibilities of a commander incident to the exercise of special and summary court-martial jurisdiction.

General Staff Functions and Techniques—I, CGSC Subcourse 4, United States Army Command and General Staff College, CA. Staff organization and staff relationships including sequence and procedures for staff action.

General Staff and Functions and Techniques—II. CGSC Subcourse 5, U. S. Army Command and General Staff College. CA. This continuation of subcourse 4, further develops the estimate of the situation and its use in solving military problems.

General Staff Functions and Techniques—III, CGSC Subcourse 8, United States Army Command and General Staff College. AA. Principles, procedures, and techniques covered in Subcourses 4 and 5 are here applied to a situation at division level. Specifically covered are mission analyses; movement of the division; intelligence and administrative activities in the initial phases of the operation; and determination of courses of action.

Infantry Division (ROCID) Offensive Operations—II, CGSC Subcourse 14. United States Army Command and General Staff College. AA. Fundamentals and techniques applicable to an infantry division in a relief in place, passage of lines, and a night attack, to include actions required by commander and staff.

Armored Division (ROCAD) Offensive Operations. CGSC Subcourse 19, United States Army Command and General Staff College. AA. Fundamentals and techniques applicable to an armored division in coordinated attack and exploitation, to include actions required by commander and staff.

Airborne Division (ROTAD) Operations. CGSC Subcourse 21, United States Army Command and General Staff College, CA, NAA. Fundamentals and techniques applicable to airborne division operations, and the air-landed infantry division in the follow-up role; use of an airborne division in a situation involving an early linkup by an armored division.

The Corps, CGSC Subcourse 22, United States Army Command and General Staff College. AA. Organization, staff procedures, techniques applicable to operation of a corps; principles and techniques employed by corps in offensive operations.

The Field Army—I, CGSC Subcourse 25, United States Army Command and General Staff College, CA, AA. Organization, staff procedures and techniques applicable to the operation of a field Army emphasizing administrative support, logistical support of atomic weapon delivery units, and rear area defense and damage control.

Large Scale Administrative Support—I, CGSC Subcourse 27, United States Army Command and General Staff College, CA,

AA. Problems of large-scale administrative support in a theater of operations; types of organizations which perform the support, and their missions.

Revised Subcourses

Records Administration I, TAG Subcourse 45, The Adjutant General's School, U. S. Army. History and basic principles of records management, including correspondence management, mail management; and records management for the smaller unit.

Records Administration II, TAG Subcourse 87, The Adjutant General's School U. S. Army. Introduction to planning, surveying, and auditing files; management and disposition of files.

Introduction to Guided Missiles. ARTY Subcourse 94, U. S. Army Artillery and Missile School. Historical background, basic theory and practical application of guided missile problems as they apply to power plants, guidance systems, warheads and launching.

Field Fortifications II, ENGR Subcourse 304, U. S. Army Engineer School. Engineer responsibilities, planning and supervision in the preparation of defensive positions, emphasizing engineer support of an infantry division; design and construction of emplacements, entrenchments, shelters.

Nonappropriated Fund Accounting and Auditing, FIN Subcourse 20, Finance School U. S. Army. Types of funds, accounting procedures, including preparation of Report of Audit.

Foreign Financial Operations Introduction. FIN Subcourse 27. Finance School U. S. Army. Introduction to overseas disbursing procedure; transactions in Military Payment Certificates; foreign currency systems; rates of exchange and transaction; financial operations in Canada; special procedures pertaining to overseas operations.

Infantry Intelligence II. Part I. INF Subcourse 55, U. S. Army Infantry School. Concept and principles of intelligence; weather, terrain, and enemy as elements of combat intelligence; sources of information available to battalion and regiment; operation and duties of S2 section; counterintelligence; intelligence training.

Military Justice XVI (Counsel). TJAG Subcourse 70, The Judge Advocate General School. Duties and functions of counsel of general courts-martial.

Signal Communications in the Theater of Operations (Equipment and System). SIG Subcourse 71, U. S. Army Signal School. Communication systems and equipment used at the various headquarters of a communications zone in a theater of operations; telephone, teletypewriter, and facsimile systems; latest developments in wire, radio and carrier systems.

Fundamentals of Teletypewriter, SIG Subcourse 161, U. S. Army Signal School. Fundamental principles of transmitting typed messages electrically including installation and operation of telegraph systems.

Basic Administrative Records. Common Subcourse 54. The Adjutant General School, U. S. Army.

Artillery Organizations—Battery and Battalion. Arty Subcourse 2. U. S. Army Artillery and Missile School.

Defense of Artillery. Arty Subcourse 32. U. S. Army Artillery and Missile School.

Storage, Shipment, and Disposal of Chemical Agents and Hazardous Chemicals II. Cml Subcourse 56 (30-12). U. S. Army Chemical Corps School.

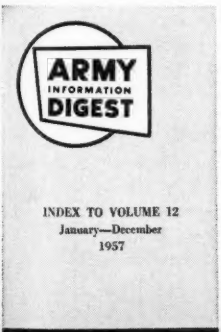
Logistics I. Engr Subcourse 4. U. S. Army Engineer School.

Field Construction. Engr Subcourse 12. U. S. Army Engineer School.

Rear Area Defense and Damage Control. Engr Subcourse 320. U. S. Army Engineer School.

Fundamentals of Telephony. Sig Subcourse 160. U. S. Army Signal School.

Chemical, Biological, and Radiological Warfare I. Inf Subcourse 30. U. S. Army Infantry School.



THE INDEX to Volume 12 of Army Information Digest has been printed and distributed. Organizations, libraries or individuals desiring to maintain their files may obtain a copy by direct request to the Editor, Army Information Digest, Cameron Station, Alexandria, Virginia.

PARAGRAPHS from the Pentagon and the Field

Combat Ready

The 101st Airborne Division recently proved that it can ready every man and every piece of fighting equipment for an air hop to combat in a day and a half. At 0400 hours Monday the division surprised more than 10,000 paratroopers with its first full-scale practice alert. By 1600 Tuesday the entire division—men, weapons, ammunition, vehicles and supplies—had reported ready for loading in aircraft that could travel anywhere in the world.

Gyroscope Revised

Beginning in December, Operation Gyroscope will be applicable only to units smaller than division-size, such as battle groups and battalion-size outfits. In operation since July 1955, the divisional rotation plan ended with exchange of the 3d and 10th Infantry Divisions in May. Although successful, the plan is being changed because of the inherent flexibility of the modernized pentomic organization that makes it more advantageous to rotate the smaller units. The new system is expected to permit a higher degree of readiness for divisions deployed overseas, since a small portion of any division will be rotating at any one time.

Research Coordination Office

The Army Research Office has been established at Fort Belvoir, Virginia, to coordinate the Army's extensive research efforts, and provide a central point of contact with the civilian scientific community. Under the direction of the Chief of Research and Development, the Office will be concerned with the continued and rapid acquisition of scientific information required by the Army to solve complicated technical problems. It will include both military and civilian scientists.

Divisional Changes

The 11th Airborne Division is being inactivated while the 24th Infantry Division is being reconstituted in Germany. The move—effective 1 July—is designed to retain a balanced divisional structure consistent with the Army's overall size during Fiscal Year 1959. The 24th Infantry Division will be a composite division of three infantry and two airborne battle groups, to make it similar in size to the new pentomic Infantry divisions.

CONARC Commander

Lt. Gen. Bruce C. Clarke, Commanding General of the Seventh U. S. Army in Germany, assumes command of the U. S. Continental Army Command (CONARC) on 1 August. He will be succeeded in Germany by Lt. Gen. Clyde D. Eddleman, who has served as Deputy Chief of Staff for Military Operations, Office of the Chief of Staff, since September 1955. Gen. Clarke succeeds Gen. Willard G. Wyman who retires 31 July after 40 years of Army service.

MAAG Orientation, Training

The Department of the Army has been designated executive agency for a new program by the Department of Defense to establish an accelerated orientation and training course for key military personnel assigned to overseas Military Assistance Advisory Groups. The course will be conducted in the Washington area by a civilian contractor. Approximately 100 Army, Navy and Air Force students will attend each of the 10 to 12 classes a year for a four-week course. They will receive intensive training in foreign policy, briefings on the country where the individual is being assigned, background on the Military Assistance Program and MAAG operations, and some specialized training for policy, technical and programming officers.

Infantry Monument

The Doughboy—replica of a life-like bronze statue that now stands in Berlin, Germany—has been mounted on a pedestal at the U. S. Army Infantry School as a monument to the glory of the Infantry-

man. Funds were raised at the U. S. Army Infantry School to purchase copyright and reproduction of the statue which depicts a soldier armed with an M1 rifle.

Food Irradiator

A large Cobalt 60 gamma food irradiator will become part of the projected U. S. Army Ionizing Radiation Center at Sharpe General Depot, Lathrop, California. The new facility will be used by the Quartermaster Corps in connection with its food preservation project, replacing the originally proposed Food Irradiation Reactor as the gamma radiation source for the Center. It will be built by the Atomic Energy Commission and the Department of Defense.

Other facilities at the radiation center will include a versatile food processing plant, laboratories, an administrative wing and a linear accelerator for use as a high electron radiation source. Target date for completion of the Center is mid-1960.

Battle Group Inactivated

One of the five battle groups—the 2d Battle Group, 19th Infantry—of the 25th Infantry Division stationed in Hawaii, is being inactivated as part of the over-all reduction in Army strength. Personnel assigned to the group have been absorbed by other units of the division which has been in Hawaii since October 1954 following service in Japan and Korea. The 2d Battle Group was a member unit of the parent 19th Infantry Regiment known as "Rock of Chickamauga" which was organized in 1861.

Paper Sandbag

Tests of a knitted paper sandbag which could replace the standard jute type in time of emergency are being carried out by the U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Virginia. The bag now under development is said to have all the physical qualities of the jute counterpart, both wet and dry. The mesh can be made as fine as desired; the paper is chemically treated for wet strength and fungicidal protection; and it can withstand normal weathering effects for more than six months. The paper sandbag's service life in water is comparable to that of the standard military jute sandbag.

Tank Crew Helmets

First helmets specifically designed for protection of tank crewmen now are undergoing intensive tests. Officially designated Combat Vehicle Crewman's (CVC) Helmet, they are constructed of multi-layers of laminated nylon fabric (similar to that in armor vests) with built-in communications system. They are designed to provide ballistic protection at least equivalent to existing steel helmets, and will cushion the head against shocks and bumps. Including communications equipment developed by the Signal Corps, the helmet weighs three pounds.

High Altitude Wind Test

Metallic confetti sent aloft to 50 mile heights in rockets is being used by Army scientists to provide data on wind behavior at high altitudes. Such information will be useful for developing new weather forecasting theories and also for delivery of long-range ballistic missiles on target.

The new method devised by scientists at the Signal Engineering Laboratories, Fort Monmouth, New Jersey, employs small Loki II rockets carrying confetti-like aluminum chaff. At a pre-timed altitude, the chaff is released in a cloud which can be tracked by radar.

In tests already made, the rockets have attained heights up to 54 miles. The light chaff has been swept along at about 200 miles an hour, and continuous measurements have been made at the maximum altitude down to less than 100,000 feet. Thus, for the first time, an unbroken map of wind speed and direction has been made possible.

Supply Management Course

A new graduate level extension course, titled Requirements Management, is being offered by the United States Army Logistics Management Center, Fort Lee, Virginia. The course is designed to develop supply management capabilities of those who hold or may hold command or supervisory position in the field of logistics. The 212-hour course consists of seven subcourses. Eligible for enrollment are Department of the Army civilian employees, members of the Army reserve components, and members of the Armed Forces in the Army logistics system.

"Pershing" Contractor

As systems contractor, the Martin Company of Orlando, Florida, will be responsible for research and development, reliability testing and production for the new solid propellant Pershing missile system. The company also will be responsible for the associated ground equipment, and will furnish engineering, maintenance, training, and field services. The Pershing, most advanced of the Army's ballistic missiles, will eventually replace the Redstone.

MOS Proficiency Testing

The U. S. Army Enlisted Evaluation Center has been set up at Fort Benjamin Harrison, Indiana, to serve as the operating agency of the Army's Enlisted Evaluation System. The System is designed to improve military personnel management by objective evaluation of individual proficiency in Military Occupational Specialties. The new agency will store and issue MOS proficiency tests which will be administered in the field. Answer sheets, together with the commander's evaluation report for each person tested, will be scored at the Center. Test results then will be returned to major commanders to provide the basis for various personnel actions.

Battlefield Electronics

In closed sessions at the U. S. Army Electronic Proving Ground, Fort Hauchuca, Arizona, this spring, top military leaders and civilian scientists discussed research and development in relation to the Army's electronic requirements on future battlefields. This was the sixth in a series of similar meetings arranged by the Army's Chief of Research and Development. Previous meetings have dealt with Infantry Weapons, Armor, Air Defense, Army Mobility, and Army Aviation Research and Development.

Scholarship Sponsors

A June graduate of a Harford County, Maryland, high school will receive a college scholarship to be presented for the sixth consecutive year by the Enlisted Specialists' Club at the Army Chemical Center, Maryland. The Club annually raises more than $600 for the scholarship. Award is made by a committee of five members, including the Harford County superintendent of schools and four representatives from the Club.

Micro-module System

As part of an approved industrial mobilization program of the Signal Corps, a $5,000,000 contract has been let to the Radio Corporation of America for production engineering of a micro-module production system. "Modules" are assemblies in which individual elements or parts are placed on ceramic-type sheets in the form of tiny wafers. These will be stacked in assemblies to make modules of the required electronic characteristics, permitting higher payloads, longer ranges or smaller sizes of missiles. The concept is expected to be developed to the point where ground tactical, fixed plant and airborne systems could be reduced to a tenth or less of their present bulk and weight.

Speakers

A standard plan has been prepared and disseminated for use by major comands within the framework of existing information programs to place Army speakers before high school and college audiences. The plan is designed to bring information about the Army to important audiences which ordinarily have limited contact with the Army.

Surveillance Drone

As part of the Army's surveillance system, a new all-weather drone system utilizing the SD-2 drone to provide combat unit commanders with information regarding the battle area has been announced. Models are currently scheduled for flight and other evaluation tests at the U. S. Army Electronic Proving Ground, Fort Huachuca, Arizona.

The entire system, including the SD-2 drones, check-out consoles, launchers, ground control system and related equipment, can be carried in two standard 6x6 trucks with attached trailers.

An improved attribute of the new drone is the plastic laminated construction of wing, fuselage and tail components. These are designed for easy field repair or individual replacement as a package. The new drone is being designed and developed by the Rheem Manufacturing Company's aircraft division at Downey, California.

Engineer Arctic Task Force Digs In

BESIDES learning how to move about on top of deep snow, the Army Engineer Arctic Task Force also is learning how to live beneath the snow itself on the Greenland Ice Cap.

During three summer seasons of testing on the ice cap, Army scientists have established that deep snow will support movement of various types of track-laying vehicles. All together, 426 tests have been conducted.

Primary purpose of these studies is to develop instruments and techniques that permit evaluation of the traffic-carrying ability of the snow. Scientists of the Army Mobility Research Center state that when studies are completed it will be feasible to estimate chances for successful operation on snow of various type vehicles. Experience also may lead to ideas for improvement of snow vehicles.

MEANWHILE, burrowing under the snow, Engineers also have built subsurface living quarters for 150 men of the Task Force at a camp 220 miles from Thule. Trenches 20 feet wide and hundreds of feet long were dug with a machine called the Peter Snow Miller. They were then spanned by wood trusses or corrugated steel, and covered over by snow.

In each sheltered trench, buildings were erected for living quarters, generator equipment, petroleum fuel storage, shop van and maintenance shop, together with an access trench which also was covered. Living quarters trenches are 600 feet long.

Although so far used only during summer months, the camp is believed suitable for year-around occupancy. The camp is equipped with electricity, snow-melting and water storage facilities, and hot and cold running water, kitchens, latrines, a sewer system, and radio.

This summer the Task Force soldiers will complete quarters and camp facilities for another 75 men.

(For views of Arctic trafficability tests and undersnow construction activities, see back cover.)

THE U. S. ARMY—A KEY TO PEACE